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THE NAIADES OF MISSOURI.

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(Plates i—xxviii.) New Series.

Introduction.

After some years of intensive studies in the field, library and laboratory an attempt is made to give a catalogued account of the *Naiades*, or Fresh-water Mussels, of Missouri. Most of the data for this descriptive and illustrated catalogue have been collected through extensive, personal surveys of the most important streams and lakes of the State and now the typical anatomical and shell material from the different localities are preserved in the writer's laboratory. No literature of any consequence, dealing with the *Naiades* of Missouri, had been produced until the author of this paper made a preliminary report on "The Mussel Resources of Missouri." This was, however, a government report, published for economic purposes, the detailed account of the scientific observations of which will not appear until a later date.

The plan of classification, based on anatomical structures, notably those of marsupial characters, has been carefully followed in this work. The many changes in the nomenclature of this catalogue from that of the Simpsonian system are due especially to the recognition of Lindahl's orthographic modification and of the wise scheme of taxonomy for the *Naiades* begun by Sterki (1906) and well consummated by Ortmann (1912); and also to the acceptance of Rafinesque's priority as recently revived by Mr. Frierson and accepted by Dr. Ortmann. The writer believes that the ultimate taxonomic system will be based far more upon the anatomical structure of juvenile and adult than upon their shell characters from the fact that the soft parts are more constant

morphologically and less liable to parallelism and convergence. We should not, however, lose cognizance of the importance concerning shell characters. External factors may so shape the shell, as to individualize it, but, under normal conditions, do not often destroy all traces of indentification with some group. Since validity is so dependent upon the examination of both hard and soft structures of large series of individuals, it is felt that the species, as recorded for their extensive and intensive studies herein, are fairly well settled within their genera. Fortunately extensive field work has made this intensive study possible. On one occasion the rare opportunity was given the author to make a mussel survey of three hundred miles down the Osage River in a row boat and ample time was given to the study of one of the richest faunae of Missouri. Two papers, "Mussel Studies Afield" for the years 1913 and 1914, are now in MS. recorded matter of which is submitted herewith. The ecologic facts secured in these field surveys are especially interesting. For example, in the long trip down the Osage, the largest tributary of the Missouri in the interior of this state, it was found that the flat or compressed forms found at the headwaters, where the water is shallower and swifter, become more swollen and heavier shells further down stream where the water is deeper and more sluggish. The most valuable data gathered from these field excursions are the ecologic as illustrated in Plates x—xiv. Much physiologic and morphologic information, however, has been obtained from these immediate studies in nature that could not be secured otherwise, since actual observation have been made of the animal carrying on the nutritive and reproductive functions there as well as observed through aquarium studies (See Plate ix). More accurate idea of the morphology (especially of soft parts as to color, form, etc.) is obtained while the specimens are fresh and uncontracted as examined afield.

While this catalogued account is rather synoptical as to the text of its animal and shell characters, yet it has been the effort to be more complete than those literary works of somewhat similar character that have devoted more space to the structures of the shell; hence, much description will be found to be completely given for the first time, notably those of *M. heros* (Say), *Q. quadrula* (Raf.) *P. Utterbackii* Frierson, *R. tuberculata* (Raf.), *U. tetralasma* (Say), *Las. suborbiculata* (Say), *Prop. capax* (Green),

Eur. (M.) brevicula (Call), *T. Curtisii* Frierson and Utterback, and *T. Lefevrei* Utterback. Aside from the morphological synopsis of the nutritive and reproductive parts and also of the external and internal features of the shell the physiological and ecological facts are especially dwelt upon in the miscellaneous remarks. Because of the value of beak sculpture and glochidial characters as bases for classification a special feature is respectively made of the studies of juveniles and glochidia. Likewise, for classificatory reasons, a Breeding Record has been kept for the most representative generic types, and, in many instances, more complete records have been made by other observers due to more detailed observations during the winter season. This Record and also the Zoögeographic account of the *Missouri Naiades* have been carefully kept in tabulated form, but, as these accounts have been reserved thus for other special papers, they will only appear here in extracts.

In this catalogue eighty species and twenty subspecies are listed. Doubtless this list will be supplemented, although the author has worked the State rather thoroughly in actual field investigations—especially Central and Northwest Missouri—and has examined all species catalogued except the following which have been reported by Missouri collectors:—*An. Bealii* (Lea), *Cy. Aberti lamarckiana* (Lea), *Pleu. plenum* (Lea), *Lamp. reeviana* (Lea) and *Lamp. Powellii* (Lea). According to a report from the material sent away for identification, this State can claim another species not yet on the list,—a new and undescribed *Lampsilis*, near to *Lamp. biangulata* (Lea), and will soon appear under the authorship of Mr. Frierson.

The author wishes to express his thanks to those who have assisted him in this work. Especially is he thankful to Dr. George Lefevre who assigned and directed this work and rendered it possible through his numerous kindnesses and suggestions. Much credit should also be given Dr. W. C. Curtis, the co-worker with Dr. Lefevre, in the University of Missouri, Department of Zoölogy, where the author gathered much of his data through the facilities of the laboratory, library and museum. Besides the invaluable instructions received from these two gentlemen, who have contributed so much to the Science of Fresh-water Mussels, it was the author's pleasure to receive many valuable hints in person from Dr. R. E. Scammon, author of "Kansas

Unionidae." For other personal help while attending the University thankful acknowledgements are due to Dr. R. L. Moodie, Messrs. G. T. Kline and F. A. Simpson. Under the illustrations of the new species (Plates v and vi) credit is given Mr. Kline, the University Artist-technician, for his excellent drawings. Through the kindness of Mr. Sampson, author of the "Mollusca of Missouri" (Exclusive of the *Unionidae*), permission has been given to examine his collections of mussel shells and make use of his list for same in determining geographic distribution and in confirming the reports of other Missouri collectors. Mr. B. F. Bush, a well-known scientist, and resident of Courtney, Mo., has rendered invaluable aid in sending for study immense collections taken mostly from the Ozark region where the author has not been permitted to carry on such exhaustive field studies as in the northern part of the State. Material from Missouri, contributed to the author's collection by Messrs. C. C. Crouch of LaGrange, E. J. Palmer of Webb City and D. K. Gregor of Fulton, has been thankfully acknowledged. The writer is deeply indebted to old collectors and authors, who were former residents of this State, viz:—Messrs. C. T. Simpson, W. A. Marsh, Elwood Pleas and Dr. John H. Britts; also to those students of *Naiades* for the nearest surrounding States viz:—Dr. F. C. Baker of Illinois, Rev. W. E. Wheeler of Arkansas, Dr. D. H. Wolcott of Nebraska, Dr. Junius Henderson of Colorado, Prof. F. B. Isely of Oklahoma and Drs. R. E. Coker, Thaddeus Surber, A. D. Howard, Prof. H. Walton Clark of Iowa. The last four named students are of the personnel of the U. S. Fisheries Biological Laboratory, located along the Mississippi at Fairport, Iowa, where the author has done some study and has had pleasant personal contact with these gentlemen who have contributed so much to the science of Fresh-water Mussels. Besides being under obligations to the above-named for their literary and conchological exchanges, as well as for their valued correspondence and actual personal assistance, special mention would also be made of Drs. A. E. Ortmann, V. Sterki, C. B. Wilson, W. H. Dall, Harold Hannibal and Messrs. B. H. Wright, Bryant Walker and L. S. Frierson. The author is most grateful to Dr. Ortmann as an authority concerning the soft parts, to Mr. Walker for his treatment of the shell parts and to Mr. Frierson for his general knowledge of *Naiades* as well as for his special information concerning the Southwest forms. Through

very pleasant and extensive correspondence with these last three named gentlemen many problems have been solved and all novelties and changes have passed through their censorship.

In order to elucidate the references in the text made to the physiography and geography an excerpt of the geographic distribution and also a tabulated Account of the Mussel Faunae of Missouri are given here, although, when it is possible to secure the desired data, it is the intention of the author to give a *detailed account of the zoogeography of the Naiades of Missouri and adjacent territory in relation to the restoration of the ancient geographic conditions of Central Mississippi Valley.*

In this connection the hydrography of the State may also be given for the sake of clearness in the use of the text. The drainage to the Mississippi is mostly through the Missouri River which flows entirely across the State just above the central line, and because of the loess soil held in suspension, together with its shifting sand bars and mud beds, it forms "*a great faunal barrier.*" Hence we may account for such a distinct mussel fauna north of the Missouri (known as "Old Muddy") from that south of it. The depauperization of mussel life is remarkable as noted in this river, together with that of the Mississippi from the mouth of the Missouri to a point below the southern boundary line of the State. The chief river basins of North Missouri belonging directly to this faunal barrier are the Chariton, the Grand, the Platte, the Nodaway and other minor ones of the Northwest. A chain of lakes, formed by the changing of the Missouri River channel into "ox-bow cut-offs," are found mostly in the north-western part of the State along the Missouri in its eastern and northern flood-plains. The largest river basins draining into the Missouri River from the south are the Osage, Gasconade and Black-water. The most important one which drains directly into the Mississippi from this State is the Meramec. The chief basins found on the south slope of the Ozarks are the White, Black and St. Francis Rivers which are drained into the Mississippi through Arkansas. South-west Missouri drains into the Mississippi River partly and directly through the Neosho.

The following is a Classified Account, (although apparently contrary to the geologic facts, yet self-explanatory), showing the distinct mussel faunae of the State that coincide with the different

physiographic provinces because of their different ecological conditions, namely, the muddy, sluggish streams of the north, swift, clear-water streams in the south and the mediocre streams of the Central portion:—

a = Prairies; *b* = Mo. and Miss. R's (Proper); *c* = Ozark Uplift.

I.—NORTH MISSOURI = Primitive Mussel Fauna.

1.a—New Prairies, or Glacial Plains. (N. and N.W. Mo.)

1.b—Missouri-Mississippi Flood-plains = Mo. Lakes and Miss. R. (Proper) to mouth of Mo. R. (N. E. Mo.).

Mo. R. (Proper) = Depauperated Mussel Fauna.

II.—CENTRAL MISSOURI = Intergraded Mussel Fauna.

2.a—Old Prairies of W. Central Mo.

1.c—Ozark Border, or North Slope.

III.—SOUTH MISSOURI = Modern Mussel Fauna.

2.c—Ozark Plateau.

3.c—Ozark Center, or South Slope.

2.b—Miss. R. (Proper) below mouth of Mo. R. and Miss.

Lowlands of S. E. Mo. = Depauperated Mussel Fauna.

The Species and Sub-Species, listed under the following general **Key to the Missouri Naiades**, are assigned to the different sub-physiographic provinces where they predominate by employing to the *extreme right after their names the lettered numbers* of the above Classified Account: e. g., ***Amblema rariplicata*** (Deshayes)—**1.a.**,—thus indicating the **New Prairies Fauna** where mostly found.

General Key for Identification of the Missouri Naiades.

This key is for very general use, being based upon the essential reproductive and nutritive characters of the animal parts for the Families, Sub-Families and Generic Groups. These characters are indicated under the lettering in the Scheme below and the enumeration of all *Naiades* for Missouri is denoted both by the Roman and Arabic numerals. The geographic distribution of the Species and Sub-Species is indicated by the lettered numbers. The following Scheme of progressive classification is employed:—

A.—FAMILY I.

(A).—SUB-FAMILY (I).

a.—GENUS I.

(a).—GENERIC GROUP AND SUB-GENUS (I).

1.—SPECIES.

(1).—SUB-SPECIES.

A.—Gills with no water-tubes, septa incomplete, obliquely arranged; gill-

diaphragm incompletely formed; supra-anal absent, branchial and anal openings suppressed with no tendency to a siphonal form; all four gills both respiratory and marsupial; post-ventral margin of mantle undifferentiated; glochida semi-circular, ventral margin with irregular dentations; tachytictic, or short period ("Summer") breeders.

FAMILY I. MARGARITANIDAE Ortmann.

a.—Gill septa oblique from base of gills, more vertically arranged and shorter ventrad.....Genus I. CUMBERLANDIA, Ortmann

1.—*C. monodonta* (Say)—(1. c).

B.—Gills always with water-tubes, septa complete and parallel with gill filaments; gill-diaphragm complete; branchial and anal openings usually tend toward a siphonal form; all four gills or only outer, or parts of outer, marsupial; glochida generally suboval, spadiform, celtiform, spined or spineless.....FAMILY II. UNIONIDAE, Swainson

(A).—Connection between anal and supra-anal openings short or absent; inner laminae of inner gills free from visceral mass; post-ventral margin of mantle not specialized; marsupial undifferentiated, not distended when gravid; glochidia suboval, spineless, tachytictic for the most part.....

.....Sub-Family (I), UNIONINAE, Ortmann

a.—All four gills marsupial.

(a)—Conglutinates club-shaped, pinkish, solid; beak sculpture concentric and slightly nodulated at base of post-umbonal ridge; disk unsculptured....Genus II. FUSCONAIA Simpson

2. *F. undata* (Barnes)—(1. b)

(1). *F. undata trigona* (Lea)—(1. c)

(2). *F. undata trigonoides* Frierson—(1. a)

3. *F. flava* (Raf.)—(3. c)

4. *F. hebetata* (Conrad)—(1. c)

5. *F. ebena* (Lea)—(1. b)

(b)—Conglutinates leaf-like, compressed, subsolid white; beak sculpture concentric, extending zigzag out on disk which is greatly sculptured.....Genus III AMBLEMA (Raf.)

6. *A. peruviana* (Lamarck)—(1. c)

7. *A. rariplacata* (Deshayes)—(1. a)

8. *A. perplicata* (Conrad)—(3. c)

(3). *A. perplicata Quintardi* (Cragin)—(1. c)

9. *A. (plicata) costata* (Raf.)—(1. a)

Genus IV. MAGNONAIAS Utterback.

10. *M. heros* (Say)—(1. a)

Genus V. QUADRULA (Raf.)

11. *Q. pustulosa* (Lea)—(1. b)

(4). *Q. pustulosa schoolcraftensis* (Lea)—(1. a)

(5). *Q. pustulosa asperata* (Lea)—(1. c)

12. *Q. quadrula* (Raf.)—(1. b)

(6). *Q. quadrula contraryensis* Utterback—(1. a)

13. *Q. nodulata* (Raf.)—(1. b)
14. *Q. fragosa* (Conrad)—(1. b)
15. *Q. aspera* (Lea)—(1. c)
16. *Q. nobilis* (Conrad)—(2. a)
17. *Q. verrucosa* (Raf.)—(1. c)
18. *Q. metanevra* (Raf.)—(1. c)
- (7). *Q. metanevra Wardii* (Lea)—(1. b)
19. *Q. cylindrica* (Say)—(3. c)

b.—Only outer gills marsupial.

- (a)—Supra-anal opening absent; beak sculpture zigzag; disk greatly sculptured.....Genus VI. *ROTUNDARIA* (Raf.)

20. *R. tuberculata* (Raf.)—(1. c)
21. *R. granifera* (Lea)—(1. b)

- (b)—Supra-anal present but short; beak sculpture concentric but disappearing toward disk which is mostly unsculptured.

Genus VII. *PLETHOBASUS* (Simpson)

22. *P. cooperianus* (Lea)—(2. c)
 23. *P. aesopus* (Green)—(1. b)
- Genus VIII. *PLEUROBEMA* (Raf.)
24. *P. obliquum* (Lamarck)—(1. b)
 - (8). *P. obliquum plenum* (Lea)—(3. c)
 - (9). *P. obliquum pyramidatum* (Lea)—(1. c)
 - (10). *P. obliquum catillus* (Conrad)—(1. c)
 - (11). *P. obliquum coccineum* (Conrad)—(1. c)
 25. *P. catillus* (Conrad)—(3. c)
 26. *P. coccineum* (Conrad)—(3. c)
 27. *P. missouriense* (Marsh)—(3. c)
 28. *P. Utterbackii* Frierson—(3. c)

Genus IX. *ELLIPTIO* (Raf.)

29. *E. nigra* (Raf.)—(2. c)
30. *E. dilatata* (Raf.)—(2. a)
- (12). *E. dilatata subgibbosa* (Lea)—(3. c)
- (13). *E. dilatata delicata* (Simpson)—(3. c)

Genus X. *UNIONERUS* (Conrad)

31. *U. tetralasma* (Say)—(1. a)
- (14). *U. tetralasma comptodon* (Say)—(1. a)

- (B).—Mantle connection between anal and supra-anal openings always present, very long and moderate; inner laminae of inner gills usually free from the visceral mass; marsupia occupying entire outer gills only, distended ventrad and with lateral water-tubes when gravid; post ventral margin of mantle not differentiated; glochidia subtriangular, or spadiform, spined; bradytictic or long period ("Winter") breederSub-Family II. *ANODONTINAE* Ortmann
- a.—Inner laminae of inner gills free from visceral mass; beak sculpture coarse, double-looped.

- (a)—Mantle connection between anal and supra-anal openings moderately long; hinge rather complete, shell sculptured and somewhat thick.....Genus XI. *SYMPHYNOTA* (Lea)

32. *S. complanata* (Barnes)—(1. a)

33. *S. costata* (Raf.)—(3. c)

Genus XII. *ARCIDENS* Simpson

34. *A. confragosus* (Say)—(2. c)

- (b)—Mantle connection between anal and supra-anal openings very long; hinge completely absent; disk smooth; shell thin.

Genus XII. *LASTENA* (Raf.)

35. *L. suborbiculata* (Say)—(1. b)

36. *L. ohioensis* (Raf.)—(1. b)

Genus XIV. *ANODONTA* (Lamarck)

37. *A. grandis* (Say)—(1. b)

38. *A. dakotana* Frierson —(1. b)

39. *A. corpulenta* Cooper—(1. b)

40. *A. Danielsii* Lea—(1. a)

41. *A. Bealii* Lea—(1. 2c)

- (c)—Mantle connection between anal and supra-anal openings moderately long; hinge almost absent; shell rather thin, disk unsculptured. Genus XV. *ANODONTOIDES* (Simpson)

42. *A. ferussacianus* (Lea)—(1. b—)

- b.—Inner laminae of inner gills with tendency to connect with visceral mass; mantle connection between anal and supra-anal openings moderate; beak sculpture, heavy, concentric.

- (a)—Marsupium with simple ovisacs; hinge teeth rather well developed with cardinals sharp and prominent.

Genus XVI. *ALAS MIDONTA* (Say)

43. *A. calceolus* (Lea)—(3. c)

44. *A. marginata* Say—(2. c)

- (b)—Marsupium with transverse ovisacs; hinge rudimentary with cardinals rounded and suppressed. . Genus XVII. *STROPHITUS* (Raf)

45. *S. edentulus* (Say)—(2. a)

- (C)—Mantle connection between branchial and anal openings present, never very long; inner laminae of inner gills rarely ever entirely free from visceral mass; post-ventral margin of mantle usually highly differentiated with papillae, flaps, etc.; part of outer gills in most genera specialized as marsupia, which, when gravid, bulging beyond original edge of gills, ruptured at ventral edge of ovisacs for escape of larvae; glochidia semi-circular, (*LAMP SILIS* type), or axe-head shape (*PROPTERA* type), ventral margin rounded, rarely spined; bradytic.

Sub-Family III. *LAMP SILINAE* Ortmann.

- a.—Marsupium with subcylindrical ovisacs; post ventral margin of mantle smooth; shell sometimes with disk sculptured, sex dimorphism of shell not distinct.

- (a)—Marsupium occupying almost entire outer gill, edges folded, ovisacs several, small, short. . . Genus XVIII. *ELLIPSARIA* (Raf.)

46. *E. clintonensis* (Simpson)—(3. c)

- (b)—Marsupium occupying outer gill in a few, large, long ovisacs.

Genus XIX. *OBLIQUARIA* (Raf.)

47. *O. reflexa* (Raf.)—(1. c)

Genus XX. CYPROGENIA (Agassiz)

48. *C. Aberti* (Conrad)—(3. c)(15). *C. Aberti lamarckiana* (Lea)—(3. c)

b.—Marsupium with compressed and dilated ovisacs; post ventral margin of mantle smooth to papillose; shell generally without disk sculpture, sex dimorphism usually very distinct.

(a)—Inner post-ventral edge of mantles without flap or papillae, but slightly lamellate and crenulated; glochidia elliptic and celtiform, when normal in shape either extremely large or small.

Genus XXI. OBOVARIA (Raf.)

Sub-Genus (I)—PSEUDOON (Simpson)

49. *O. (Pseudoon) ellipsis* (Lea)—(1. b)

Genus XXII. NEPHRONAIAS (Cross and Fisher)

50. *N. ligamentina* (Lamarck)—(1. b)(16). *N. ligamentina gibba* (Simpson)—(1. c)51. *N. ellipsiformis* (Conrad)—(1. c)(17). *N. ellipsiformis venusta* (Lea)—(1. c)52. *N. Pleasii* (Marsh)—(3. c)53. *N. ozarkensis* (Call)—(3. c)

Genus XXIII. AMYGDALONAIAS (Cross and Fisher)

54. *A. donaciformis* (Lea)—(1. a)55. *A. truncata* (Raf.)—(1. c)

Genus XXIV. PLAGIOLA (Raf.)

56. *P. securis* (Lea)—(1. b)

Genus XXV. LASMONOS (Raf.)

57. *L. fragilis* (Raf.)—(1. a)58. *L. Simpsonii* (Ferriss)—(3. c)59. *L. leptodon* (Raf.)

Genus XXVI. PROPTERA (Raf.)

60. *P. alata* (Say)—(1. a)61. *P. purpurata* (Lamarck)—(3. c)62. *P. laevissima* (Lea)—(1. a)63. *P. capax* (Green)—(1. b)

(b)—Inner post-ventral edge of mantle differentiated with papillae and flaps; glochidia normal in shape, medium in size.

Genus XXVII. CARUNCULINA (Simpson)

64. *C. parva* (Barnes)—(1. b)65. *C. texensis* (Lea)—(1. a)66. *C. glans* (Lea)—(1. a)

Genus XXVIII. EURYNIA (Raf.)

Sub-Genus (II). MICROMYA (Agassiz)

67. *E. (Micromya) limosa* (Conrad)—(3. c)68. *E. (Micromya) iris* (Lea)—(3. c)69. *E. (Micromya) brevicula* (Call)—(3. c)(18). *E. (Micromya) brevicula Brittsii* (Simpson)—(1. c)

Sub-Genus (III). EURYNIA (sens. strict.)

70. *E. (Euryنيا) subrostrata* (Say)—(1. a)71. *E. (Euryنيا) recta* (Lamarck)—(1. c)

Genus XXIX. LAMPSILIS (Raf.)

72. *L. anodontoides* (Lea)—(1. a)73. *L. fallaciosa* (Smith)—(1. a)74. *L. Higginsii* (Lea)—(1. b)75. *L. Powellii* (Lea)—(3. c)76. *L. luteola* (Lamarck)—(3. c)(19). *L. luteola rosacea* (DeKay)—(3. c)77. *L. reeviana* (Lea)—(3. c)78. *L. ventricosa* (Barnes)—(3. c)(20). *L. ventricosa satura* (Lea)—(3. c)

Genus XXX. TRUNCILLA (Raf.)

79. *T. Curtisi* Frierson and Utterback—(3. c)80. *T. Lefevrei* Utterback—(3. c)

ENUMERATION OF MISSOURI NAIADES.

FAMILIES.....	2
SUB-FAMILIES.....	3
GENERA.....	30
SUB-GENERA.....	3
SPECIES.....	80
Sub-SPECIES.....	20
TOTAL OF SPECIES AND SUB-SPECIES.....	100

Explanation of Figures.—For the purpose of illustrating the characteristic structures of the animal a few text-figures have been inserted immediately under the different Sub-Families. All figures illustrating these characters are about life-size and, while they are drawn from actual specimens in gravid condition, yet the sketches are more or less diagrammatic in order to emphasize the essential features. The sketches of the glochidia (most of them *figured here for the first time*) are actual camera-lucida drawings by using lenses to magnify 87 diameters. In both sets of these inserted figures, as well as in some of the plates at the close of the text, the following meanings are given to the letters for the labels:—

A=anal opening;	I=inner gill;
AN=anterior end;	M=marsupium;
AV=antero-ventral margin;	P=palp;
B=branchial opening;	PO=posterior end;
D=dorsal, or hinge line;	S=supra-anal opening;
F=foot;	V=ventral margin.

Explanation of Terms, Abbreviations, etc., used in the text, bibliography and check list.—A few technical terms introduced

here are suggested for general use. Reference to the four sections of the shell or mantle edges, limited by the anterior, posterior, dorsal and ventral extremities, can be expressed adjectively and adverbially by the respective terms, "*antero-ventral*," "*antero-ventrad*," "*post-dorsad*," etc. (See Plates I—III). "*Spadiform*" (shape of a spade head) and "*celtiform*" (shape of a celt, or axe-head) are used as adjectives in describing glochidia. In a few shell measurements adoption has been made of Scammon's term, "*umboidal ratio*," (*um ra.*) which is secured by dropping a line perpendicularly from the tips of the beaks to the longitudinal axis and expressing the distance from the intersection of the two lines to the anterior margin of the shell as a decimal fraction of the entire length of the longitudinal axis. The term, "*interdentum*," is used here for the bridge between the lateral and cardinal teeth. The terms, "*bradytictic*" and "*tachytictic*," as suggested by Ortmann, are adopted as meaning respectively, "long period" and "short period" breeders. The term "*diaphragm*," is also used here for the partition between the branchial and anal openings formed by the gills.

All shell measurements are reckoned in terms of millimeters (mm.) and length, height and diameter are considered consecutively. "*Diameter*" is the distance between the greatest convexities of closed valves. All other usages employed in this work have been in such common adoption as to need no explanation.

To make plain those parts of this catalogue,—especially the Synonymy and Bibliography,—the equalities for the abbreviations are given as follows:—

- Am. J. Conch.—American Journal of Conchology.
- Am. Jl. Sci. and Arts.—American Journal of Science and Arts.
- Am. Nat.—American Naturalist.
- An. Car. Mus.—Annals of the Carnegie Museum.
- Biol. Bull.—Biological Bulletin.
- Bull. Wash. Coll.—Bulletin of Washburn College.
- Bull. U. S. Mus.—Bulletin of the United States Museum.
- Bull. U. S. B. F.—Bulletin of the United States Bureau of Fisheries.
- Jl. (or Jour.) Ac. N. Sci. Phila.—Journal of the Academy of Natural Science of Philadelphia.
- J. Cinn. N. Hist. Soc.—Journal of the Cincinnati Historical Society.
- Jl. Phila. A. Sci.—Journal of the Philosophical Academy of Science.
- Mal. Soc. Lon.—Malacological Society of London.
- Moll. Chicago, Pt. I.—Mollusks of Chicago, Part I.
- Monog. Biv. Ohio.—Monograph of the Bivalves of Ohio.

Naut.—Nautilus.

N. Harm. Diss.—New Harmony Disseminator.

Pr. (or Proc.) Ac. N. Sci. Phil.—Proceedings of the Academy of Natural Science, Philadelphia.

Pr. Am. Phil. Soc.—Proceedings of the American Philosophical Society.

Pr. Mich. Ac. Sci.—Proceedings of the Michigan Academy of Science.

Pr. Ohio Ac. Sci.—Proceedings of the Ohio Academy of Science.

Pr. U. S. Nat. Mus.—Proceedings of the United States National Museum.

Tr. (or Trans.) Ac. Sci. St. Louis.—Transactions of the Academy of Science of St. Louis.

Tr. Am. Fish. Soc.—Transactions of the American Fish Society.

Tr. Am. Phil. Soc.—Transactions of the American Philosophical Society.

U. S. B. F. Ec. Cir.—United States Bureau of Fisheries, Economic Circular.

U. S. B. F. Doc.—United States Bureau of Fisheries Document.

(To be continued.)

NOTES ON OUR LOCAL PLANTS.—XI.

BY J. A. NIEUWLAND.

Lake Maxinkuckee (Clarke).

BRASSICA Cicero, Cato, Pliny XIX:8, XX:9.

Brassica Linn., Syst., (1735), Gen., 197 (1737), 299 (1754), Tour., Els., 188 (1694), I. R. H., 219 (1700) also V. Cordus, Brunfels, Lobelius, Tragus, Eric. Cordus, Matt., Lonicer, Gesner Tabernaemontanus, Castor Durante, Dodonaeus, Fuchs, Turner, etc., etc.

Brassica Napus Linn., Sp. Pl., (1753).

Napus sylvestris Bauhin, Pinax, 95 (1623), *Napus sativa* C. Bauhin, l. c.

Lake Maxinkuckee, (Clarke). Found escaped from cultivation, as also is *Brassica Rapa* and *Brassica oleracea*.

CAKILE Serapion, Semp., c. 65 (1531). Also *Cakile Cusa*, Camerarius, *Cakile* Linn., Syst., (1735), Gen., 196 (1737) 300 (1754), Tour., Els., (1694), I. w. H., 212 (1700), *Cakile* Miller, Gard. Dict., Abr., Ed. 4 (1754).

Cakile edentula (Bigel.) Hook., Fl. Bor. Am. I. 59 (1830).

Bunias edentula Bigelow, Fl. Bort., 157 (1814).

Millers (Umbach), Lake Co. (Deam). Laporte Co., (Deam) 211, 9062 Millers. Common only in the dune region of Lake Michigan near the shore line.

DENTARIA Lobelius, Obs., 391 (1576).

Dentaria Tour., Els., 192 (1694), I. R. H., (214 1700), *Dentaria* Linn., Syst. (1735), Gen. 196 (1737) 295 (1754), *Dentaria* Clusius, C. Bauhin, Pinax, 322 (1623), Gerard, Tabernaemontanus, Camerarius, Caesalpinus, etc. *Dentellaria* Dalechamps, Cusa.

Dentaria lacinata Muhl., Willd. Sp. Pl., III, 479 (1800).

Cardamine laciniata Wood, Bot. and Florist, 38 (1870).

Lake Maxinkuckee (Clarke), St. Joseph Co. (Rothert), Laporte Co. (Deam). 3590, 11081½ Notre Dame (Powers) 452 South Bend, Ind., 11081 Notre Dame. Common throughout the region. It varies considerably in leaf shape. Some specimens have almost entire leaves, others broadly parted, and others further dissected and laciniate.

SINAPIS Dioscorides 2:154, Theophrastus 7:3 and 6 Pliny XIX:68, XX:22.

Sinapis Linn., Syst., (1735) Gen., 197 (1737), 299 (1754), Tour., Els., 193 (1694), I. R. H., 277 (1770), *Sinapis* Brunfels, Fuchs, Turner, Castor Durante, Matthioli, Lacuna, Caesalpinus, Dodonaeus, and of all the older authors.

Sinapis alba Linn., Sp. Pl., 668 (1753).

Brassica alba (Linn.) Boiss.

2501, Notre Dame, (Powers), 9325, 9306 Notre Dame.

Sinapis arvensis Linn., Sp. Pl., 668 (1753).

Notre Dame, Ind.

Family 77. **CAPPARIDEAE** Vent., Tabl. III,

118 (1794).

Capparidaceae Lindley, Nat. Syst., ed. 2, 61 (1836).

JACKSONIA Raf., Med. Rep., V, 352 (1838).

Polanisia Raf., Am. Month. Mag. 267 (1818) also Jr. Phys., 89, 98 (1819).

Jacksonia trifoliata Raf. l. c.

Polanisia graveolens Raf., Jr. Phys. l. c., *Polanisia dodecandra* B. S. P. Cat. N. Y. 6 (1888); *Cleome dodecandra* Michx., Fl. Bor. Am., 2, 32 (1803) not *Cleome dodecandra* Linn.

South Haven, Berrien Co., Mich. (L. H. Bailey), 11524 Notre Dame, Ind. 9750 Dune Park, Lake Co. Common in sandy banks of the St. Joseph River and in the Dune region as also along the railroads.

Family 78. **SARRACENIACEAE** Dumort. Anal.
Fam. Pl., 53 (1829).

Also Engler and Prantl Pflanzfam. Nachtr. 348 (1897).

BUCANEPHYLLUM Plukenett, Alm. 71 (1696).

Also Almath. 46, t. 376, f. 6 (1705); Phytog. 3, t. 152, f. 3 (1692), *Coilophyllum* Morison Hist. 3, 523 (1699), *Sarracena* Tour. I. R. H., App. 657, pl. 476 (1700), also Linn., Syst. (1735). Index of Sp. Pl. (1753). Gen. 149 (1737), 224 (1742), 226 (1754), *Sarracenia* Sp. Pl. 510 (1753).

Bucanephyllum americanum Pluk. Almag (1696) and Almath. l. c. (1705).

Sarracenia purpurea Linn., Sp. Pl. l. c. *Sarracena canadensis* Tour. l. c. *Bucanephyllum purpureum* (Linn.).

Laporte Co. (Barnes), Lake Co. (Hill), Clarke, Ind. (Umbach) Casella, Ind. (Higdon and Raddin), Lake Maxinkuckee (H. W. Clarke), 2787 Mineral Springs (Porter Co.) 9650 Chain Lakes, St. Joseph Co., 2672 Sagunay, Laporte Co. Found also in a tamarack swamp along the Turkey Creek road S. E. of South Bend, Ind. in Cass Co., Mich. near Bankson Lake, also W. of the same lake in great abundance growing with *Isotria verticillata* (Willd.) Raf. *Pseudorchis Loeselii* (Linn.) S. F. Gray. [*Leptorchis Loeselii* (Linn.) Dum.] N. and *Calopogon pulchellus* R. Br. or *Cathea tuberosa* (Linn.) Mac M.

Family 79. **DROSERACEAE** DC., Theor. El. 214
Prod. I, 317 (1724).

RORELLA Valerius Cordus, Hist., 86 (1561).

Also *Salsirora* l. c. *Thalius*, Hare. 116 (1588). *Rorida* Lobelius, Icon. 81 (1581) also Adv. and Obs. 472 and 354 (1576) *Rorella* Allioni, Fl. Pedem. II, 88 (1785) Haller, Fl. Helv., 371 (1768), Ruppius Jen. 90 (1726), 114 (1745), *Thalius* l. c. Lobellius l. c. *Rossolis* Adans., Fam. Pl. II, 245 (1763), *Ros solis* and *Ros Solis* Els. 211 (1694), I. R. H. 245 (1700), C. Bauhin, Pinax, 356 (1623) and of many pre-Linnaean authors, e. g. Dodonaeus, Lonicer. Castor Durante, Camerarius, Hort. Med. 742 (1588). *Drosion* Lobelius, Obs. Syn. l. c. *Solaria* Camerarius l. c. syn. *Drosera* Linn., Syst. (1735), Gen. 89 (1737) 136 (174).

Rorella Cordi Lobelius, Obs. 472, et in indice (1576).

Rorella vulgaris Ruppius l. c. *Ros solis* major Gerard, *Drosera*

rotundifolia Linn., Sp. Pl. 281 (1753), *Rorella rotundifolia* (Linn.) Allioni, l. c.

Casella, Ind. (Higdon and Raddin), Lake Co., (S. Coulter), Lake Maxinkuckee (H. W. Clarke), 223, 9460. Cass Co., Mich., Clarke, Ind. (Umbach).

***Rorella intermedia* (Hayne).**

Drosera intermedia Hayne in Schrad. Jr. Bot. 1, 37 (1800), *Drosera americana* Willd., Enum 340 (1809).

Lake Co. (S. Coulter), Millers, (Bastin), 10246 Mineral Springs, Porter Co. In a bog of the dune region at the edge of a pond which usually dries up completely in summer. During the very dry weather of Aug. 1913 the peat caught fire and the whole region was devastated. All vestiges of the plant were destroyed and it has not reappeared. Found in close promimity of *Scleria verticillata* and *Polygala cruciata* which also are now gone.

Order 28. CALOPHYTAE.

Bartling, Ord. Nat. Pl. 330, 398 (1830).

Rosales Lindley. Nix. Pl. 21 (1833). Bentham and Hooker, Gen. 1, 13 (1865), Engler and Prantl., Pflanzfam. Nachtr. 348 (1897).

Family 80. **CRASSULACEAE** DC., Bull. Plilom.

49 (1891).

Also Lam. DC., Fl. Fr. 3, 4, 382 (1805), Bartling, l. c. 224 and 309 (1830).

SEDUM Pliny, Hist. 26 : 8, also Columella.

Sedum, *Cepaea* or *Telephium* of nearly all the pre-Linnaean writers, See C. Bauhin, Pinax 284, 287, 288 (1623), *Anacampseros* Gesner, *Sedum* Tour. Els. 229 (1694), I. R. H. 262 (1700), *Sedum* Linn. Syst., (1735), Gen. 136 (1754).

***Sedum triphyllum* (Haw.) S. F. Gray. Nat. Arr. Br. Pl. II, 540 (1821).**

Anacampseros triphylla Haw., Syn. Pl. Succ. 111 (1812).

Lake Maxinkuckee (Clarke). Found at Notre Dame, Lakeville, N. Liberty, Mishawaka, Benton Harbor, and St. Joseph. Common and spreading in woods near farm houses.

***Sedum minimum* Tabernaemontanus, (1580) Lobelius Adv. (1576).**

Aizoon acre Cordus Hist. 98 (1561), *Sedum acre* Linn. Pan Suecus, Amoen II, 248 (1751). Sp. Pl. 432 (1753).

Escaped from gardens and graveyards. Notre Dame, Ind., St. Joseph, Mich., Mishawaka, Ind.

Family 81. **PENTHORACEAE** Rydberg. N. Am.

Fl. 22, 75 (1905).

PENTHORUM Gronovius, Fl. Virg., 51 (1739).

Penthorum Linn., Gen., 204 (1742), 197 (1754). Linn. Act Upsla. 12. t. 2 (1744).

Penthorum sedoides Linn., Sp. Pl., 432 (1753).

Lake Maxinkuckee (Clarke), Clarke, Ind. (Umbach), Lake Co. (Deam), Pine, Ind. (Umbach, Steele), Bascom, (W. Hahn), Notre Dame, 9380.

Family 82. **PARNASSIEAE** S. F. Gray, Nat. Arr

Br. Pl. II, 623 (1821).

Parnassiaceae Dumort., Anal. Fam. 37, 42 (1829).

PARNASSIA Tour. Els. 212 (1694), I. R. H. 246 (1700).

Parnassia Linn., Syst., (1735), Gen. 87 (1737); 133 (1754); also Haller, Helv. 316 (1742) *Enneadynamis* Gesner, Hort. Germ., 261 (1561) in syn. Six-syllabled word!

Parnassia caroliniana Michx., Fl. Bor. Am. I, 184 (1803).

Lake Co. (Deam, Hill), Lake Maxinkuckee (Clarke), 2112 Chain Lakes, 11623 Notre Dame, 3987 Notre Dame (Powers).

Family 83. **SAXIFRAGEAE** Vent., Tab. III, 277 (1799).

Saxifragaceae DC., Lam. and DC. Fl. Fr. 3, IV, 358 (1805) also Prod. IV, 1 (1830). Endlicher, Gen. 813 (1839).

MICRANTHES Haw. Syn. Pl. Succ. 320 (1812).

Saxifraga of authors in part.

Micranthes pennsylvanica (Linn.) Haw., Saxifr. Enum.

Saxifraga pennsylvanica Linn., Sp. Pl., 399 (1753), also Dillenius, Hort. Eltham. 337 (1732).

Clarke, Ind. (Umbach), Lake Maxinkuckee (Clarke), St. Joseph Co. (Rothert), Lake Co. (Hill), 1880, 9461, 1886 420 Notre Dame, 9197 Granger, St. Joseph Co., Ind., 830 N. Liberty, Ind. Common in all the counties in moist ground.

HEUCHERA Linn., Syst. (1735), Gen. 68 (1737), 106 (1754). Hort Cliff. 82 (1737).

Heuchera americana Linn., Sp. Pl., 226 (1753).

Turkey River (Clarke).

Heuchera hispida Pursh, Fl. Am. Sept., 188 (1814).

Lake Maxinkuckee (Clarke), Lake Co. (Hill).

Heuchera hirsuticaulis (Wheelock) Rydberg Britt. Man.
482 (1901).

Heuchera hispida hirsuticaulis Wheelock, Bull. Torr. Cl.,
17, 199 (1890).

Marshall Co. (Deam), 10528 Notre Dame, 9681, 9440 Chain
Lakes, 43 Granger, Ind.

TIARELLA Gen. 190 (1754).

Tiareella cordifolia Sp. Pl. 405 (1753).

St. Joseph Co. (Rothert.)!

I have nowhere found it within the region.

MITELLA Tour., Els. 207 (1694) I. R. H. 241 (1700),

Mitella Linn., Syst., (1735), Gen. 131 (1737), 190 (1754).

Mitella americana Tour., Els. 207 (1694).

Mitella diphylla Linn., Sp. Pl. 406 (1753).

Grand Haven, (Umbach), St. Joseph Co. (Rothert), Notre
Dame, 4008, 2036, 4009 (Powers), Notre Dame, 1891, 10008,
406, 815, 2527, 2534.

CHRYSOSPENIUM (Tabernaemontanus). Tour. Els., 122
(1694), I. R. H. 146 (1700).

Also Linn., Syst. (1735), Hort. Cliff. 149 (1737), Gen. 115
(1737), 189 (1754).

Chrysosplenium americanum Schwein. in Hook. Fl. Bor.
Am. I. 242 (1832).

Chrysosplenium oppositifolium Walt., Fl. Car. 140 (1788)
not Linn.

Lake Maxinkuckee (Clarke), Porter Co. (Deam), 810, 10012
Notre Dame.

Family 84. **HYDRANGEACEAE** Dumort., Anal.

Fam. 36, 38 (1829).

PHILADELPHUS Athenaeus, Dipnosophistae, XV:29,
probably.

Philadelphus C. Bauhin, Pinax, 398 (1623). *Syringa* Tour.
Els. 491 (1694), I. R. H. 617 (1700), *Philadelphus* Linn. Syst.
(1735), Gen. 140 (1737), 211 (1754), *Syringa* of a great many of
the pre-Linnaean authors, the name used also for the Lilac.

Philadelphus coronarius Linn., Sp. Pl. 470 (1753).

Escaped around Notre Dame by seed and maintaining itself well under very unfavorable conditions.

Family 85. **HAMAMELIDACEAE** Lindley, Veg.

Kingd. 784 (1847).

Hammamelideae Abel. Nar. Jour. China. App. B. 374 (1818), DC. Prod. IV. 267 (1830).

TRILOPUS Mitchell, Act. Acad. Leop. Carol. VIII, App. 211 (1748) also (1769).

Hamamelis Linn., Gen. 254 (1742), 559 (1754) not *Hamamelis* of the older authors which was a pomaceous plant, (*Mespilus* Sp.)

Trilopus virginiana (Linn.) Raf., New. Fl. N. Am. III, 17 (1836). cor.

Hamamelis virginiana Linn. Sp. Pl., 124 (1753).

Laporte Co. (Deam), Lake Co. (Deam), Porter Co. (Deam), Clarke, Ind. (Umbach), Marshall Co. (Deam), Lapaz Junction, Marshall Co., 11119, Millers, Ind., 2648, Mineral Springs, Porter Co., 10211, 11540, 11031, 11034, 10211, St. Joseph, Mich., 470, Michigan City, Laporte Co., 9262, Notre Dame, 9343, 10439, 11737, 11737, 10439, 11125.

Trilopus virginiana var. *angustifolia* Nwd.

Hamamelis virginiana var. *angustifolia* Nwd. Am. Nwd. Nat. III, 63 (1913).

Hudson Lake, Laporte Co., 10431.

Trilopus virginiana var. *orbiculata* Nwd.

Hamamelis virginiana var. *orbiculata* Nwd. Am. Mid. Nat. l. c. p. 64.

Tamarack, Porter Co. Ind. 719, Mineral Springs, 11641.

Family 86. **GROSSULARIACEAE** Dumort. Anal.

Fam. Pl. 37 (1829).

GROSSULARIA Ruellius, Hist. Stirp. 213 (1543).

Also Tour. Els. 501 (1694), I. R. H., 639 (1700), Miller, Gard. Dict. Abr. (1754), Clusius, Hist. (1605). *Rocella* Cardanus.

Grossularia Cynosbati (Linn.) Miller. Gard. Dict. Ed. 8, (1768)

Ribes Cynosbati Linn., Sp. Pl. 202 (1753).

Millers (Umbach), Lake Maxinkuckee (Clarke), Lakeville 9260, Benton Harbor, 11012, Notre Dame, 1970 (Powers),.

Grossularia missouriensis (Nutt.) Cov. and Britton, N. Am. Fl. 22, 221 (1908).

Ribes gracile Pursh, Fl. Am. Sept. 165 (1814). *Ribes missouriense* Nutt., T. and G., Fl. N. A. 1, 548 (1840).

Notre Dame (Johnson) [Calumet, S. Chicago (A. Chase)].

RIBES Fuchs, 1542 also Ruellius, Nat. Stirp. 213 (1543).

Ribesium Dodonaeus, Pempt. 749 (1583), Dill., Hort. Elth., 324, 246 (1732), *Ribes* Lobelius, Clusius, Besler, *Ribes* Linn., Gen. 68 (1737), 94 (1754). Included in *Grossularia* by Tournefort.

Riles vulgare Lamarck, Encycl. 3, 47 (1789).

Escaped in places.

COREOSMA Spach, Veg. Syst. VI, 154 (1838) also Ann. Nat., Ser. II, IV, 2 (1835).

Coreosma and *Calobotrya* Spach, Veg. Syst. I. c.

Coreosma americana (Miller).

Coreosma florida Spach, Veg. Syst. I. c. 157. *Ribes floridum* L'Herit., Stirp. Nov. 1, 4 (1784). *Ribes americanum* Miller, Gard. Dict., ed. 8, (1768).

Lake Maxinkuckee (Clarke), Lake Co. (Blatchley), 1969 Notre Dame (Powers), 1910, 2539, 11010 Notre Dame, 825 North Liberty, 11121 Lapaz Junction.

Coreosma americana var. **mesochora**.

Differt a praecedente floribus pubescentioribus (an semper?) angustioribus longioribus, foliis plus incisiss serratis majoribus, racemis diffusioribus longioribus, *Sepalorum partibus linearibus acutiusculis, tubo longioribus*, petalis quoque multo longioribus, angustioribus.

This variety found in the dune region in the edge of a tamarack arbor vitae bog, is characterized by very narrow acutish sepal lobes rather long and very narrow, linear to linear oblanceolate acute or obtusish. The leaves are deeper and more sharply cut and serrate, and larger. The racemes long and with widely scattered flowers. The plant has long straggling branches, and generally of more slender habit. The twigs are grayish white and it blooms about half a month or more later.

Found at Mineral Springs, Porter Co., Ind., May 29, 1913. No. 11061 Notre Dame University Herbarium.

Coreosma odorata (Wendl.)

Chrysobotrya revoluta Spach, An. Sc. Nat. 2 ser. IV. t. 1 A. (1835) also Hist. Nat. Veg. VI. 149 (1838), *Ribes odoratum* Wendl.,

Bartl. and Wendl. Beitr. 2, 15 (1825), *Ribes aureum* Pursh, Fl. Am. Sept. 164 (1814).

Persisting as an escape, Notre Dame, Ind., also at Webster's Crossing.

Family 87. **PLATANACEAE** Lindley, Nat. Syst.,
ed. 2, 178 (1836).

PLATANUS Theophrastus, III : 7.

Also Pliny, X: 44, XXIV: 8, Dioscorides I: 107, Varro, I: 7, Claudius, Hymen, Palladius, de Ins. 87, *Platanistos* Homer, Iliad B: 310, Theoc. XVIII: 44, *Platanus* Tour., Els. 463, I. R. H. 590 Linn., Syst., (1735), Gen. 358 (1737), 433 (1754) and of all the older authors before Linnaeus.

Platanus occidentalis Catesby, Ornith.

Platanus occidentalis Linn., Sp. Pl., 999 (1753), *Platanus occidentalis aut virginienensis* Park. Theatr. 1427 (1690).

Lake Maxinkuckee (Clarke), 2042 Notre Dame (Powers).

Family 88. **SPIRAEACEAE** Loiseleur-Delong-
champs, Man. Pl. Indig. 1, 188 (1818).

Also Nouv. Voy. dans L'Empire Flor. 284 (1817) as sub-family, also Bartling, Ord. Nat. Pl. 230, 403 (1830), Spach, Hist. Nat. Veg. I, 427 (1834).

ULMARIA Clusius, Pann., 699, 700 (1583).

Also Gesner, Camerarius, Tabernaemontanus, etc. *Medesusium* Cordus, Hist. (1561) (?) *Ulmaria* Tour., Els., 231 (1694), I. R. H. 265 (1700), Stricto sensu. *Spiraea* Sp. Linn., Under *Spiraea* Linn., Gen. 216 (1754), Sp. Pl., 489 (1753), inclusive of *Filipendula*, and *Aruncus*. *Filipendula* Syst., (1735), and Gen. 145 (1737), Hort. Cliff. 191 (1737) inclusive of *Ulmaria*.

Ulmaria rubra Hill, Hort. Kew. 214, pl. 7, (1769).

Spiraea lobata Gronov. Jacq. Hort. Vind. 138, pl. 88 (1770), *Spiraea rubra* Britton, Bull. Torr. Bot. Cl. 18, 270 (1891). *Filipendula rubra* Robinson, Rhodora, 8, 204 (1906).

10483 Bertrand, Mich., Berrien Co., (B. Gregory.)

SPIRAEA Theophrastus, 1: 23.

Spiraea Tour., Els 490 (1694) I. m. H., 613 (1700) also C. Bauhin, Pinax, 475 (1623), *Spiraea* Clusius Hist., 1, 80 (1605).

Spiraea alba Duroi, Harb. Baumz. II, 430 (1772).

Spiraea salicifolia lanceolata T. and H., Fl. N. Am., 1, 145 (1840).

Notre Dame, 9377, 1897, 11460.

Spiraea latifolia (ait.) Bork. Handb. Forstbot. 1871 (1803).

Spiraea salicifolia latifolia Ait., Hort. Kew. 2, 198 (1789).

9085 Notre Dame, 9756, Dune Park.

(Plants reported as *S. salicifolia* from Lake Maxinkuckee (Clarke). Porter Co. (Deam), Laporte Co. Deam). I have been unable to verify as to which of the above they may be.)

Spiraea tomentosa Linn., Sp. Pl., 489 (1753).

Lake Maxinkuckee (Clarke), Millers (Umbach), Laporte and Porter Cos. (Deam), Dune Park (A. Chase), Notre Dame 1899, 3319.

OPULASTER Medic., Pfl. Anat. 2, 109 (1799).

Physocarpa Raf., N. Fl. N. Am. 3, 73 (1836), *Physocarpus* Maxim., Act. Hort., Petrop., 6, 219 (1879).

Opulaster opulifolius (Linn.) Kuntze, Rev. Gen. Pl. 949 (1891).

Spiraea opulifolia Linn., 489 (1753), *Neillia opulifolia* Brewer and Watson, Bot. Calif., 1, 171 (1876).

Lake Maxinkuckee (Clarke), Lake Co. (Umbach), Notre Dame 7815, 1919 (Powers) Notre Dame 566, 568, 499, 2449, St. Joseph, Mich. 33 Stephansville, Berrien Co., Mich. 2723.

Family 89. **DRYADEAE** Vent., Tabl., III, 346.

Also Bartling, Ord. Nat. Pl. 230 (1830), *Fragariaceae* Rich Nestl. Potent. 14, *Comosae* Linn., Phil. Bot. 31 (1751)!

PENTAPHYLLUM Dioscorides, 4:42, Theophrastus, Hist. 9:14.

Pentaphyllum Brunfels, Herb. Viv. Ic., II, 231 (1532), 1, 32 (1531), Ruellius, Diosc. Nat. Med. 4:34 321 (1547).

Quinquefolium Pliny, 25:9, *Quinquefolium* and *Pentaphyllum* Ruellius, Nat. Stirp. 598 (1542) see also Theodore Gaza, ed. Theoph. 134 (1528), Marcellus Vergilius ed. Diosc. 485 (1529), *Pentaphyllum* Heister, Syst. Pl. 7 (1748). Hill, Br. Herball 3 (1756), Gaertner, Fruct. 1, 349 (1788), *Quinquefolium* Morandi, Hist. Bot. Pract., 9 (1761), *Quinquefolium* Robbe in De Chaunles, Cat. de Pl. Usuelles (1754)! also Adanson 2, 294, 295 (1763).

Pentaphyllum rectum (Linn.).

Potentilla recta Linn., Sp. Pl., 497 (1753), *Potentilla sulphurea* Lam., Fl. Franc. III, 144 (1778).

Millers (Umbach), 2735, 11314, Oliver's, West of South Bend, Ind.

Pentaphyllum argenteum (Linn.).

Potentilla argentea Linn., Sp. Pl., 497 (1753).

St. Joseph Co. (A. Woolman, Barnes), Laporte Co. (Deam), Notre Dame (Powers) 2024, Bertrand, (Augustine), 9336.

The type of the Linnaean aggregate "genus" *Potentilla* is without question *Potentilla Anserina* Linn., although Dr. Britton says it is *Potentilla reptans* Linn. The latter is without doubt the oldest known potentillaceous plant of the pre-Linnaean genera *Quinquefolium* or *Pentaphyllum* but Linnaeus by the very fact that he rejected these names for his aggregate, intimated that in selecting the name therefore he selected also the type of the group from which he took the name for his nondescript genus. Now the plant which before Linnaeus was known as the *Potentilla* of pre-Linnaeans is *Potentilla Anserina* Linn. The name was so first applied by Brunfels. Now it may be argued that by making 1753 the beginning of our nomenclature we need not accept "historical" types of genera. Now *P. Anserina* Linn. is not the oldest plant of the aggregate genus to which Linnaeus gave the name *Potentilla* as already stated, therefore not what we would call the historical type of the "group." We believe, however, that when Linnaeus took the name for the group he sufficiently intimated *ipso facto* and apart from historical reasons, that when segregations were subsequently to be made the name was to be retained for the plant that previously had it. If Dr. Britton and the followers of the theory of residues argue that *Potentilla reptans* Linn. is the type historically and that the historical type should always be selected, then why is not *Panicum talicum* selected as type of *Panicum* or *Milium* instead of putting it in a segregate and applying the name *Panicum* to a group of plants which the originator of the name never knew? Why is *Nymphaea alba* Linn. the undoubted historical type of the genus *Nymphaea* segregated and the original name given to the other plant or plants of the genus? In fact as far as one can see no system whatever is followed in the decision of the manner of determination which plants are the Linnaean "types." All this illogical practical procedure of segregation of Linnaean genera and type selection seems to have as its object the avoidance of confusion. We wonder if they can possibly think they can hope to "avoid confusion" by applying methods as above outlined.

We need not discuss why Linnaeus disregarded the centuries-

old names *Quinquefolium* or *Pentaphyllum*. We can not be presumed to give reasons for the arbitrary method of Linnaeus in this case nor in hundreds of other cases, any more than we wish to presume to explain the arbitrary methods of selections of his types, by his modern followers. It can not be done logically, but we believe that he is to be presumed to want to have the name of a genus left to the group or plant that had it before. Dr. Rydberg² dismisses the whole pre-Linnaean history of the group because the plants were in "such a chaotic condition that it would be impossible to write a history of any value." This is a very expedite way of settling a problem, but it will never help settle confusion in the long run. As long as we resort to methods of expediency in clearing up problems, rather than by applying logical principles we are making confusion worse confounded.

On a number of occasions we have quoted Linnaeus himself writing both before and after 1753 as to his idea of method to be followed in segregating his genera. In the *Philosophia Botanica* p. 197 of both editions, 1751 and 1755, he says: "*Si genus receptum secundum jus naturae, and artis in plurima dirimi debet, tum nomen antea commune manebit vulgatissimae et officinali plantae.*" In the *Hortius Cliffortianus* his most careful work *Potentilla Anserina* is the first plant mentioned. Only a one-named designation is given in the *Species Plantarum* as synonym thus intimating that it was the *Potentilla* par excellence in his opinion, as it was deemed fit to give the name to the group. Of course we are not even supposed according to the theory of residues and the peculiar methods of interpretation of priority to allow Linnaeus to correct his own mistakes or determine his own types when as seldom he does not seem at least to intimate an opinion in the matter.

There is, however, still another point to make and that is that in assigning the theory of residues to effect segregation, the author of the illustrated flora is not consistent.

The segregated genus *Argentina* is attributed to Lamarck (1778). *Pentaphyllum* and *Quinquefolium* were separated from the Linnaean *Potentilla* with *Pentaphyllum* (or *Quinquefolium*) *reptans* [*Potentilla reptans* Linn.] by numerous authors before 1778. If the author feels that it is necessary to accept *Argentina* because segregated first leaving the other plant in possession of the name

² Mem. Dept. Bot. Columbia Univ. Vol. II. p. 2. Monograph N. Am. Potentill. (1898.)

Potentilla by virtue of the theory of residues, then we may say that *Pentaphyllum* was separated as validly as soon, if not sooner, leaving *Potentilla Anserina* as the type even if we apply the very theory of residues to which appeal may be made to excuse the procedure referred to. *Pentaphyllum* was separated from the Linnaean *Potentilla* by Ludwig-Boehmer (1760), special reference being made to *Potentilla reptans* in its specific name. ("*Potentilla joliis digitatis caule repente pedunculis unifloris*, Linn. Sp. Pl. p. 499 N. 17"). In fact segregation of *Pentaphyllum* were made as early as 1754! Possibly the segregations may be looked upon as "hyponyms" perhaps because not published in connection with a binary name? Hill segregated the plant under the name *Pentaphyllum vulgare* in 1756, twenty-two years before Lamarck's date of *Argentina*.

That it is very hard to find just by what principle of nomenclature as to residues, types, priority and the like, the Illustrated Flora (1913 ed) was written we may select the following examples. *Bildedychia* Dum (1827) certainly antedates *Tinaria* Webb. and Moq. (1836-40). The author we feel confident knows that the name *Pentaphylloides* is older than *Dasiphora*. It would scarcely do for the author to say that he rejects names ending in *oides* for he has such not a few. *Bildedychia* is not a very beautiful name, but there are others in the Flora that are worse in more ways than one. *Thelypteris* is an older name than *Dryopteris*, but why not acceptable to the Illustrated Flora is a problem we can not hope to solve. Perhaps, *Thelypteris* was not published in connection with a binary name. Nor for that matter were Linnaeus' own genera *Erythronium* *Hydrocharis* etc. as elsewhere pointed out.

That the author does not put much stock in the theory of residues would appear from the fact that the common Dandelion is kept under *Leontodon* contrary to all the precedent of a century or more, and in spite of the fact that *Taxaxacum* was first segregated from the Linnaean aggregate. An exactly parallel procedure would result in the acceptance of *Nymphaea alba* Linn. for type of *Nymphaea* and the reduction of *Castalia* to synonymy although older than *Nuphar*. This would be the logical thing to do by every principle of analogy and reasoning.

Historically there can be no question that the white water lilies are typical of the genus. Even Dioscorides himself brings

this out. Following is the translation of his text made by Ruellius as early as 1547.³

"*Nymphaea nascitur in paludibus and stagnantibus aquis foliis fabae Aegyptiae, minoribus albiis in summa aqua alis demersis pluribus ex radice eodem prodeuntibus FLORE LILIO ALBO, and in medio crocos habente, cum defloruerit, ut rotundum malum aut papaveris caput extuberat. . . . est et altera nymphaea cujus flos blephara dicitur foliis ante dictae radice albo scabro; FLORE LUTEO nitente rosae simile etc.*

There are other inconsistencies not a few which we can not comprehend. We have tried our best to try to imagine how one can logically explain these matters, but so far are unable to do so. No reasons being given for methods of procedure which may be applied in one case and rejected in a perfectly similar one, one would suspect that the code tinkers reserve for themselves the privilege of keeping or breaking the rules as suits their fancy. "Rex super legem," seems to be the rule when most of the botanical public must take their rules of nomenclature and botany second-hand, diluted, expurgated and altered to the whims and fancies of the manualists.

POTENTILLA Brunfels ex C. Bauhin Pinax, 321 (1623).

Argentina Ray meth. 102 (1682) Dodonaeus Hist, 65 (1557) Lobelius Hist. 395 (1576), Dodonaeus Pempt, 589 (1583) *Argentina* Hill, Br. Herb. 6, (1756) Trew, Herb. Blackw., 119 (1755). *Anserina* Tabernaemontanus Kreutterb. 327 (1625), also *Chenoboscon* and *Hercularis* and *Potentilla* and *Portentilla*, *Anserina* Tragus, *Potentilla* Matthioli, Fuchs Hist. and Stirp, 2 lib, and 212a (1546). Stirp Hist. 355 (1549), Caesalpinus De Plantis 557 (1558), also Lonicer, Castor Durante, Thalius, *Stephanomelidides* Pliny? *Dactylophyllum* Spen., Fl. Frib., 3, 1084.

Potentilla Anserina Linn., Sp. Pl., 495 (1753).

Argentina vulgaris Lam., Fl. Fr., 3, 1778), *Anserina Anserina* Rydb. Mem. Dept. Bot. Col. Un., 2, 159 (1898), and Four. Ann., Soc., Linn., Lyon., (11) 16, 302, 404 (1863), *Dactylophyllum Anserina* Spen. l. c., *Fragaria Anserina* Crantz, Stirp. Austriac., 2, 9, ed. 27, (1771).

St. Joseph Co., (C. D. Mell), Clarke, Ind. (Umbach), Lake

³ Diosc. Anazarb. III. cap. CXXXVI. ed. Ruellius, T. p. 289 (1547). See also Sibthorp J. Prod. Fl. Graec. 360, 362 (1806).

Co. (Hill), Porter Co. (Cowles), 2688) Galien, Mich., 2721 Stephenville, Mich.

DRYMOCALLIS Fourr., l. c. II, 16, 371, (1868).

Boottia Bigelow, Fl. Bost., ed. 2, 206 (1826), not Adanson (1763).

Drymocallis agrimonoides (Pursh) Rydb. N. Am. Fl. 22, 368, (1908).

Drymocallis arguta (Pursh). *Potentilla arguta* Pursh, Fl. Am. Sept. 736 (1814). *Geum agrimonoides* Pursh Fl. Am. Sept., 351 (1814).

Found at Notre Dame and at Galien, Mich.

TRIDOPHYLLUM Necker Els., 2, 93 (1790).

Potentilla Linn. l. c.

Tridophyllum monspeliense (Linn.) Greene, Leaflets, 1, 189 (1906).

Potentilla monspeliensis Linn., Sp. Pl., 499 (1753).

Laporte (Deam), Notre Dame, 10434.

Tridophyllum norvegicum (Linn.) Greene, l. c.

Potentilla norvegica.

Notre Dame 2625 (Powers).

CALLIONIA Greene, Leaflets, 1, 238 (1906).

Named after one of the gardener slaves of Theophrastus, Callion!

Callionia canadensis (Linn.) Greene l. c.

Potentilla canadensis Linn. Sp. Pl., 498 (1753).

Millers (Umbach), Lake Maxinkuckee (Clarke), Laporte Co., (Deam) 3866, 2026 Notre Dame (Powers), 10572 Notre Dame. A common weed throughout the region.

DASIPHORA Rafinesque, Aut. Bot., 167 (1838).

Pentaphylloides Duhamel, Traite des Arbres et Arbustes, 99 (1755), also Morison, Ox., 2, 193 (1715). *Comocarpa* T. and G., Fl. N. Am., 1. 445 (1840) as subgenus under *Potentilla*, *Comocarpa* Rydb., Mem. Col. Un., 2, 19, pl. 101 (1898).

Pentaphylloides rejected for reasons already given.

Dasiphora fruticosa (Linn.) Rydb., Mem. l. c. 188.

Potentilla fruticosa Linn., Sp. Pl., 495 (1753), *Dasiphora riparia* Raf. l. c., *Pentaphylloides fruticosa* Ray, Syn., 3, 2561, *Comocarpa fruticosa* Rydb., l. c. pl. 101.

Lake Co. (Deam, Bradner), Lake Maxinkuckee (Clarke),

Indiana Harbor, (A. Chase), 530, 881, 914, Chain Lake, 758 Sagunay.

PANCOVIA Heister, (1737) ex Adanson, 2, 294 (1763).

Comarum Linn., Sp. Pl., 502 (1753), also Hort. Cliff., 195 (1737). Gen. 148, (1737), 220 (1754). *Comarum* rejected because it is the exact Greek equivalent for *Fragaria*.

Pancovia palustris (Linn.).

Comarum palustre Linn. Pan. Suec. 249 (1751), Sp. Pl., 359 (1753). *Potentilla palustris* Scopoli, Fl. Car. 2, 359 (1772).

Lake Maxinkuckee (Clarke), Clarke, Ind. (Umbach), Lake and St. Joseph Cos. (Blatchley), 545, 885 Chain Lakes, 2624 Millers, Lake Co.

FRAGARIA Cuba, Hort. Sanit., 15th Century.

Also *Fragaria* Brunfels Herb. Viv. Ic., (J. de Manliis) 2, 173 (1531), *Fragula* Cordus, Hist., 173 (1561), *Fragaria* Tour., Els., 245 (1694) I. R. H. 295 (1700) also Tragus, Fuchs, Dodonaeus Gesner, Lonicer, Lobelius, Castor Durante, Gerarde, etc., Linn., Gen., 147 (1737), 218 (1754).

Fragaria vulgaris Tour., Els., 245 (1694), et C. Bauhin Pinax, 326 (1623).

Fragaria vesca Linn., Sp. Pl., 494 (1753), *Fragaria vulgaris* Linn., Pan Suecus, 259 (1751).

Highland Park, (J. Shaddock), 1950 Notre Dame. Found very commonly along railroads from seed probably thrown from trains.

Fragaria grayana Vilmorin; Gay, Ann. Sci. Nat., IV., 8, 202, (1857).

Found in St. Joseph Co.

Fragaria virginiana Duchesne, Hist. Nat. Fras., 204 (1766).

Lake Maxinkuckee (Clarke), Grand Haven (Umbach), Pine (Umbach), 10096, 12430 Mineral Springs.

GEUM Pliny 26:7.

Geum Gesner, Hort. Germ., 260 (1561) also Turner, *Caryophyllata* Tour. Els. 244 (1694), I. H. R., 294 (1700), also Matthioli, Lacuna, Thalius, Castor Durante Tabernamontanus, Camerarius, Clusius, Gerarde, Anguillara C. Bauhin, etc. *Garyophyllata* Brunfels, Tragus, Dodonaeus, Lonicer.

Geum canadense Jacquin, Hort. Vind., 2, 82, pl. 175 (1772).

Geum carolinianum Walt., Fl. Car., 150 (1788), *Geum album* Gmel., Syst., 2, 861 (1791).

Michigan City (C. D. Mell.), Lake Maxinkuckee (Clarke),
44. Granger, 2698 Notre Dame, 2683, 9615 South Bend.

Geum virginianum Linn., Sp. Pl., 500 (1753).

Lake Maxinkuckee (Clarke), Porter (Dean), St. Joseph
Co. (Barnes).

Geum strictum Ait., Hort. Kew., 2, 217 (1789.)

1829, 1828 Notre Dame, 869 Grand Beach, Berrien Co.

STYLIPUS Raf., Neog., 3 (1825).

Stylipus vernus Rafinesque, l. c.

Geum vernum T. and G., Fl. N. Am., 1, 422 (1840).

501, 9615, 10112 South Bend, 430, 9139, 2705 Notre Dame.

RUBUS Vergil, Ecl. 3:89, Georg., 3315.

Batos Theophrastus, Hist., 2:16, 3:16, 6:1, Caus., 1:21, Diosc.
4:38, *Rubus* Pliny, 16:37, 24:14, Colum., 3:11, 4:31, 7:6, Apulej.
Cels. 7:27, 6:14.

Rubus canadensis Linn., Sp. Pl., 494 (1753).

Lake Maxinkuckee (Clarke), St. Joseph (Rothert), 2061
Notre Dame (Powers).

Rubus allegheniensis Porter, Bull. Torr. Bot. Cl., 23, 153
(1896).

9145, 9134, 11179, 506 South Bend.

Rubus hispidus Linn., Sp. Pl., 493 (1753).

Lake Maxinkuckee (Clarke), Millers (Umbach), 9148 South
Bend, 9277 Granger, Ind.

Rubus hispidus forma, *pleniflorus*.

Plant with doubled flowers and stamens nearly all gone.
Leaves with leaflets larger and the stalks beset with slender prickles.
Flowers intensely sweet smelling pure white like a small doubled
rose.

11252 collected near Summit Farm No. 4 west Sample St.
about 4 or 5 miles from South Bend, Ind. This might prove a
good plant for garden cultivation but has been so far difficult
to grow as the plants can hardly be transplanted without dying.
It blooms longer than the type and seem to continue most of the
summer, and often blooms again late in fall. It grows in dense
shade along the road where it was cleared from the neighboring
woods.

Rubus procumbens Muhl., Cat., 50 (1813).

Rubus villosus Ait., Hort. Kew., 2, 210 (1789).

Lake Maxinkuckee (Clarke), Miller, Ind. Clarke (Umbach)
9307 Notre Dame.

Rubus baileyanus Britton Mem. Torr. Cl. 5, 189 (1894).

Rubus villosus var. *humifusus* T. and G., Fl. N. Am., 1. 455
(1840) not Weihe, (1825).

Lake Maxinkuckee (Clarke), 1310., 11198 Notre Dame.

Rubus andrewsianus Blanchard, Rhodora, 8, 17 (1906).

1902, 11239 N. Notre Dame, Ind.

Rubus triflorus Richards, Franklin Journ., ed. 2, App., 19
(1823).

Rubus saxatilis var. *canadensis* Michx. Fl. Bor., Am., 1. 298
(1803), not *Rubus canadensis* Linn. (1753), *Rubus saxatilis* var.
americanus Pers., Syn. 2, 52 (1807).

Millers (Umbach), Lake Co. (Hill), 2333 Lawton, Mich.,
11303 W. of South Bend 2784, 10097 Mineral Springs.

BATIDAEA Greene, Leaflets, 1, 238 (1906).

Batidaea strigosa (Michx.) Greene, l. c.

Rubus strigosus Michx., Fl. Bor. Am., 1, 297 (1893),
9257, Birchim, Porter Co., Ind., Porter Co., (Deam), Lake
Co., (Deam), 10210 Mineral Springs. Common throughout the
region.

Batidaea heterodoxa Greene l. c.

Clarke (Umbach).

Batidaea vulgaris (Linn.).

Rubus idaeus Pliny 16:37, also Tragus, Matthioli, Anguillara
etc., etc., also *Rubus idaeus* Linn., Sp. Pl., 492 (1753), *Batos idaeus*
Diosc., 4:39. *Batidaea idea* (Linn.)

Found escaped near Hudson Lake.

MELANOBATUS Greene, l. c. 243.

Melanobatus occidentalis (Linn.) Greene l. c.

Rubus occidentalis Linn., Sp. Pl., 493 (1753).

Lake Maxinkuckee (Clarke), 9136 S. South Bend, 11669
Mineral Springs. Common also at Notre Dame and throughout
the region.

Family 90: **SANGUISORBEAE** Spreng., Anleit. ed.

211, 861 (1818).

Sanguisorbae Juss., Gen., 336 (1789), *Sanguisorbaceae*.

EUPATORIUM Dioscorides 4:41.

Eupatorium Tragus, Matthioli, Fuchs, Dodonaeus, Cordus,

Castor Durante, Lacuna, Turner, Tabernaemontanus, Lobelius, Thalius, Gesner, Anguillara, Columna, Brunfels, Pliny, 256, etc., etc., *Agrimonia* Brunfels, Dodonaeus, Lonicer, Caesalpinus, Linn. Gen., 138 (1737), 206 (1754) Tours., Els., 251 (1694), I. R. H., 301 (1700).

***Eupatorium molle* (T. and G.).**

Agrimonia mollis Britton, Bull. Torr. Cl., 19, 221 (1892).
Agrimonia Eupatoria var. *mollis* T. and H. Fl. Am., 1. 431 (1840).
 Found in Lake Co. 11636 Mineral Springs, 11442 S. E. Notre Dame, 10303 S. South Bend.

***Eupatorium hirsutum* (Muhl.).**

Agrimonia Eupatoria var. *hirsuta* Muhl., Cat., 47 (1813),
Agrimonia hirsuta (Muhl.) Bicknell, Bull. Torr. Cl., 23, 509 (1896),
Agrimonia gryposepala Wallr., Beitr. Bot., 1. 49 (1842).

Lake Maxinkuckee (Clarke), Porter Co., (Deam), 11260, 11698 S. South Bend, Ind., 1886 Notre Dame, 10465 Bertrand, Mich., Berrien Co.

***Eupatorium rostellatum* (Wallr.).**

Agrimonia rostellata (Wallr., Beitr. Bot., 1. 42 (1842), *Agrimonia parviflora* DC. Prod., 2, 588 (1825) not Soland (1789).
 11700 S. South Bnd, Ind.

***Eupatorium parviflorum* (Soland.).**

Agrimonia parviflora Soland., Ait., Hort. Kew., 2, 130 (1789).
 Millers (Umbach), Michigan City (C. D. Mell), Lake Co. (Deam.)

(To be continued.)

QUAMOCLIT SLOTERI.

BY J. A. NIEUWLAND.

Whatever view be taken of the status of the remarkable plant produced by Mr. Logan Slotter in crossing *Quamoclit coccinea* (Linn.) Britton (*Impomoea coccinea* Linn.) with *Quamoclit vulgaris* Choisy (*Impomoea Quamoclit* Linn.) we have beyond doubt a plant which if found in the field without any knowledge as to its origin, we must admit that the most conservative botanist would scarcely hesitate to report it as a new species. The hybrid in question breeds true to type and was produced between the former as

pistil parent and the latter as pollen parent. The plant differs in having laciniately cleft leaves with linear to lanceolate divisions very irregular so that few are quite alike in shape. The venation in the upper part of the leaf is of the pinnate type but the leaf blade as a whole is broader than long, the basal veins branching on the pedate plan. The base is obtuse and without mesophyll on the margin without, as the veins proceed from the apex of the peduncle directly. This peculiarity is probably due to the tendency of the product to attempt to follow as nearly as may be, the pinnate leaf type of *Quamoclit vulgaris* and at the same time also that of *Quamoclit coccinea*, the apical lobe usually being the broadest. The sepals are rounded to obtuse and even retuse (mucronate) and about as long as in the former plant but broader. The corolla is of the same color, roundish pentagonal, shaped nearly as in the latter species the flowers being much larger than in either parent. The flowers are as numerous to the cluster as in *Q. coccinea*, the peduncles longer, the petioles as long. Though the plant seems not notably prolific in moister situations the abundance of flowers is quite remarkable.

The plant is a good and not very common example of what has been called a "species hybrid" as distinguished from a Mendelian hybrid, or a "mutant." Professor E. C. Jeffrey¹ considers mutants and we would infer also "species hybrids" as just "crypto hybrids," because as the result of his investigations these plants are notably devoid of perfectly fertile numerous microspore cells. As the plant in question does not produce much seed such might probably be the case with its pollen. The test for hybridism according to the writer is found in the fact that partial infertility is the characteristic of the plants supposed to be mutants even when they reproduce at all, thus reducing these plants to the condition practically of sterile or partially sterile hybrids as was maintained by the English horticulturalists of a century ago.² Herbert,³ however, at the same time having produced hybrids that bred true to type and differed from their parents by characters notably different so as to be considered specific differentiations, viewed these products as new species in opposition to the general opinions of his day. Not having examined the pollen of *Quamoclit*

¹ Jeffrey, E. C., Spore Conditions in Hybrids and the Mutation Hypothesis of De Vries, Bot. Gaz. LVIII, 322 (1914).

^{2, 3} See Transactions Hort. Soc., London Vols. I—VII (1812 et seq.)

Sloteri no opinion could be proposed here, but it may be suggested that the apparent infertility or partial fertility of the plant may be due perhaps also to the fact that it has not been grown in conditions suitable. Its production of flowers increases very noticeably as also its seed product by reducing its moisture. The plant might perhaps be quite fertile under conditions which may have not as yet been perfectly determined. Perhaps too under natural conditions comparatively few new species have survived, apparently because the conditions for their proper persistence were not at hand.

Since the plant, *Quamoclit Sloteri* possesses characters that are notable enough to make it seem specifically distinct from either parent and from all of the members of the genus; why should the knowledge of its ancestry militate against it as deserving a "species" name in binary nomenclature? With its character of breeding true it deserves to be ranked as a new plant as truly as the mutants or new species published under *Oenothera* during the last decade. It is likely that many species unequivocally ranked as such found in the field, have fewer characters of distinction than the plant in question.

In reading over a description of a certain *Quamoclit multifida* Raf. (1835) I was forcibly struck by the fact that the characterization of this plant is practically identical with that of the plant produced by Mr. Sloter, from whom the details of the origin of *Quamoclit Sloteri* were directly obtained. The following description from Rafinesque's New Flora of North America, Part IV, p. 57 (1836) seems so remarkably applicable that one would fain believe that that keenly observant and brilliant botanist of nearly a century ago had in mind and actually seen somewhere in gardens of his day a plant identical with the Scarlet Climber just described. It is not impossible that it has appeared spontaneously in gardens where the two parents were often grown together. The whole description of Rafinesque is here given so that it may be compared by the reader, who may judge for himself as to their identity. To us there seem little doubt that Rafinesque knew of a plant whose description agrees in our opinion quite well with that of the plant hybrid under discussion.

"976 *Quamoclit multifida* Raf. Twining, smooth, leaves multifid, lacinate, base truncate, sinuses obtuse, segments linear and lanceolate acute, peduncles 3-5 flors, equal to petiols, calix acute—a

curious sp. deemed a garden hybrid produced by *Q. coccinea* and *Q. pinnata*, leaves variously cut few alike, some reniform with shorter cuts, flowers handsome, large purple, tube clavate, limb flat stellate pentagone, stamens exserted. Seen alive in gardens, where sometimes spontaneous."

The *Quamoclit* *pinnata* Raf. above is certainly *Ipomoea Quamoclit* Linn., Sp. Pl., 159 (1753), the only pinnate leaved *Quamoclit* known by him at the time, and it is moreover the oldest binary application of the plant under the genus *Quamoclit* antedating Choisy's name *Quamoclit vulgaris*¹ nine years, unless of course one admits the stupid duplicate binaries like *Quamoclit Quamoclit*.

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CROCION ACHLYDOPHYLLUM (GREENE.)

An Ecological and Anatomical Study.

BY R. M. KACZMAREK.

In "Studies in Viola I" in the AMERICAN MIDLAND NATURALIST in the February issue of 1914 we intimated that the presence or absence of cleistogamous flowers in plants in the genus *Viola*, as hitherto held by most botanists, is becoming a recognized character for classification. It was undertaken to segregate the plants of this group taking into consideration their habit and the number of stamens in the so-called "apetalous flowers" when present. On account of these important characters of distinction we proposed the segregates on the basis of this difference.

We proposed the genus *Crocion* Nieuwland and Kaczmarek² for the stemmed yellow violets of which *V. pubescens* (Ait.)³ is the type. In our opinion the western plant confused by botanists under the name of *V. eriocarpa* (Schwein.)⁴ is really *V. achlydo-*

¹ Whether the *Ipomoea Cardinalis* (Cardinal Creeper) offered by A. Boddington, of New York, is the same as *Quamoclit Sloteri*, I have been unable to find.

² Am. Mid. Nat. III., 8, p. 207-217 (1914).

³ Ait. Hort. Kew. 3, p. 290 (1789.)

⁴ Schwein. Am. Journ. Sci. 5, p. 75 (1822).

phylla (Greene)¹ sufficiently different from the above by its own characters as may be seen by consulting his description. As to the advisability of applying the name *V. eriocarpa* (Schwein.) to the eastern plant even, we would hardly venture too definite a statement as both *V. scabriuscula* (Schwein.), as that plant was formerly known, and *V. pubescens* may or may not have hairy capsules. If the meaning implied in the name is taken as the prime character for substituting the name *V. eriocarpa* (Schwein.) for what was formerly known as *V. scabriuscula* (Schwein.) then one could for the above reason seem scarcely justified in adopting the change.

The use of the name *V. eriocarpa* Schwein., though apparently an older name were scarcely perhaps legitimate because it is not clear that *V. pubescens* variety *eriocarpon*² (Nutt. 1818) is not a different plant. If it were a different plant as would seem from the context of Nuttall's description of his plant and Schweinitz' discussion then the latter's name is a homonym. That the plants are not the same might be interpreted from the attempt of Schweinitz to change the name to *V. scabriuscula*. The argument would be therefore that Nuttall's plant is really nothing more than a hairy fruited variety of *V. pubescens*. The following synonymy would show this interpretation of the matter:—

Crocion scabriusculum (Schwein.) Kaczmarek.

V. scabriuscula (Schwein.) T. & G. Fl. N. A. 1 p. 142, (1838).

V. eriocarpa (Schwein.) Am. Jour. Sci. V. No. 1, p. 75 (1822)
not *V. pubescens* variety *eriocarpon* (Nutt.) Gen. North Am. Pl. 1. p. 151 (1818).

It has been decided to examine the plant anatomically as well as other plants under the old genus *Viola* to ascertain whether there are any ecological and anatomical characteristics that would distinguish them from one another.

ECOLOGY OF THE SEEDLING.

The ovules are anatropous. The seeds of brownish tint measure about 1-1.5 mm. in width and 2-2.5 mm. in length and contain endosperm. In germination the root first emerges from the seed and then the hypocotyl begins to elongate with the result that the epigeal cotyledons, sooner or later, appear above the

¹ Greene, E. L., *Pittonia*, 5, p. 87 (1902).

² Nutt. Gen. North Am. Pl. 1, p. 150 (1818).

surface of the soil, fully expand and begin to perform the functions of assimilation until future foliage leaves appear; then they finally wither and leave two scars in older seedlings opposite the rhizome. This rhizome arises partly from the epicotyl and partly from the hypocotyl. The lower margins of the scars are joined by a shallow line traversing the ventral face of the rhizome. The cotyledons of seedlings examined were more or less, ovate to orbicular in outline with a tendency toward a better development of one half of the lamina. The apices of the cotyledons are notched and a faint yet quite evident mid-rib runs from the apex of the cotyledon to its base. Between the petioles of the cotyledons a very small bud or growing-point pyramidal in shape constitutes the plumule or epicotyl. The plantlet with all the essential organs of vegetation namely primary root (Fig. 1-4, Pr.), hypocotyl (Fig. 1, Hl.), cotyledons with their petioles (Fig. 1, Cot.), and the epicotyl begin subsequent development the rate of which depends upon the appropriation of food entirely from without. Very little food was stored in the cotyledons. Sooner or later after the cotyledons are exposed to the light there are noticeable changes manifested not only in length but also in diameter of all the plant parts. The hypocotyl, however, at first very delicate of nearly equal diameter, begins to expand at the upper extremity gradually tapers as it nears the primary root so that both form a more or less elongated cone with base below cotyledons and apex at the distal end of the primary root. The root soon develops many lateral branches beset with root-hairs. The development of foliage leaves from the tissue of the epicotyl proceeds rapidly (Fig. 3A and B). The leaf originates from the node in the axis between the petioles of the primitive leaves and is then carried upward by the development of the lower internode due to vertical expansion. Later, however, there is in the axis of the raised node another leaf formed which is soon separated from the lastly formed leaf and node by tissue that forms another internode. So there is an internode formed after each successive nodal formation differentiating the stem into nodes and internodes.

The hypocotyl which until now together with the primary root was approximately in the same vertical plane with it, begins to bend upon itself assuming as it does so a more or less horizontal position, dragging toward the ground its apical part. Once under ground the whole of the hypocotyl with a portion of the epicotyl

begins a rapid growth in thickness. The increase in thickness is confined chiefly to the region where the hypocotyl becomes continuous with the epicotyl. The former soon begins to produce secondary roots and these are confined mainly to the lower part. With the appearance of secondary roots, the primary root begins to wither or rot and it is represented in seedlings of further development as a black filament or scar (Fig. 2). Fig. 3 A shows what is left of it in the second season of growth.

Although the hypocotyl with that part of the epicotyl that becomes subterranean, assumes a diageotropic position or a position of equilibrium, the primary root maintains and the secondary roots assume a downward growth. It is from this underground diageotropic portion of the seedling that the rootstock develops, the product of the hypocotyl and a part of the epicotyl (Fig. 3-4), the former soon disappearing. If the seed is already underground the hypocotyl when covered with dead leaves or other debris elongates until the cotyledons are exposed to the atmosphere. There are then produced secondary roots from the hypocotyl not far from the cotyledons when the remaining part of the hypocotyl together with the primary root decays. As the plant ages the nodes and internodes become more or less horizontal and give origin to many adventitious roots. The more or less transitional development of the seedling is shown rather clearly in Fig. 1-4.

VEGETATIVE PROPAGATION.

During the spring and early summer of the year 1912 and 1913, while studying the cleistogamous flowers of the violets together with the ecology of seedlings and their structure and the anatomy of mature plants of some of the violets of this region there was found besides some interesting facts regarding the habits and anatomy, one peculiarly characteristic of the plant, namely, that of vegetative propagation. Vegetative propagation, in the sense applicable to this plant and to *Crocion pubescens* (*Viola pubescens* Ait.) is possibly shown by others of the same groups also is although not uncommon nevertheless quite rare in the manner about to be described.

While gathering seedlings of this plant in St. Mary's Ravine, Notre Dame, Indiana, one mile west of the University of Notre Dame, that this fact was first brought to our notice. Seedlings

varying with age were gathered and among them were some plantlets the roots of which seemed so old and large as to excite suspicion that they were not real seedlings of the previous season's germination. On tracing the course of the roots it was found that they were those of a central mature plant towards which they radiated inward from all directions. In the majority of cases the plantlets seemed to take origin from roots that had decayed or were decaying and had been severed from the parent plant. Once or twice only was it found that the root that bore a plantlet still had a pronounced communication with the parent, though the region around the origin of the plantlet showed a rather unhealthy condition. This phenomenon, however conclusive called for actual experimentation in order to substantiate former observation in the field.

A number of roots, preference given to those that were fully mature and in normal state of health, taken at random and gathered from many parents not in close proximity were planted in our laboratory in boxes. The greatest precautions were used in taking soil specially sifted and selected so as to exclude seeds of violets. Placed in the light, the ground was kept under conditions of moisture and light as near as possible to those of the natural habits of plants. From time to time the roots were examined to see whether they would show such characteristically localized regions of decay, as seen in those in their natural conditions and surroundings prior to giving rise to young plants. In about three weeks degeneration occurred in the cut ends of the majority. It is from this partially decayed part of the root that a bud soon appeared made up of scales and followed by one or two well developed leaves. This showed conclusively that the violet reproduced new plants vegetatively from old roots.

Among the many parts of seedlings and mature plants brought up in paraffin were included besides the mature healthy roots, roots showing different stages of decay with some bearing plantlets for comparative study of the fibrovascular arrangement and also to investigate the region of plantlet origin. The fibrovascular arrangement was alike in roots showing decay and in those perfectly normal (Fig. 13-14). The plantlets originate from the region surrounding and including the pericycle. The anatomy of these propagated plants was not further studied after determining that they were more or less like seedlings themselves in structure. Fig. 5 shows two old roots severed from the parent,

the upper one bearing two young plants one some distance from the other at the distal extremity; the lower one, in which decay took place at the extremity next to the parent, bears but one plant. Study of *Lophion striatum* (*Viola striata* Ait.) seems to indicate that this process of vegetative propagation takes place also from its roots though no experiments were made to determine this beyond doubt. Subsequent observations of yellow violets in the field show that vegetative multiplication is very common in the members of the *Crocion* group.

THE ANATOMY OF THE SEEDLING.

THE PRIMARY ROOT. (Figs. 6-7).

In cross section the single vascular bundle (stele, central cylinder) of the primary root (Fig. 6-7) is well marked being of the radial type with leptome (phloem) on either side of the hadrome (xylem). The hadrome arrangement is diarch exarch; that is, the initial hadrome vessels (protohadrome, protoxylem) are found externally to the subsequent hadrome vessels (metahadrome, metaxylem) which are formed centripetally. The first hadrome vessels developed are of the spiral and annular type of small lumen with the former in the majority. The tracheae of the metahadrome though larger in caliber possess the same markings that the initial tracheae. The vascular bundle is limited externally by a single layer of cells, forming a continuous membrane, the pericycle. This is homogeneous, formed of thin-walled flattened parenchymatous cells which are bounded externally by the endodermis which encloses the stele.

There is soon developed from the embryonal meristematic tissue the procambium a region of actively dividing cells the secondary meristem or cambium found between the protohadrome and protoleptome giving rise subsequently to secondary hadrome on the inner side and secondary leptome on the outer side.

The extrastelar fundamental tissue (periblem, primary cortex) is limited internally by the endodermis inclusively and externally by the epidermis exclusively. The endodermis is composed of a single layer of cells which show in cross section suberization along their lateral walls. The endodermis in vertical section is differentiated from the cells within by elongation in the vertical direction and are somewhat narrower than the cells immediately exterior.

The cells composing the periblem are parenchymatous with cellulose walls more or less polyhedral in outline and elongated vertically. In older specimens the cells become more or less irregular in outline with intercellular spaces and contain few starch grains. The hypodermis is composed of a single layer of cells. These differ from the inner cortical layers of cells in having their cell walls thickened and more so on the lateral and external walls. (Fig. 6 Hy.)

The epiblema is composed of a single layer of cells which are somewhat longer anticlinally. The cuticularisation is much more pronounced than in the cell walls of the hypodermis. The epiblema of more advanced primary roots shows quite an amount of cutin on the outer walls of the cells, where it gives rise to a layer of, more or less, equal thickness (cuticle) (Fig. 6-7 Ep.).

THE HYPOCOTYL. (Fig. 8).

The cross section of the hypocotyl (Fig. 8) was made a little below the petioles of the cotyledons. The intrastelar tissue although presenting no peculiarities different from those of the well advanced primary root, shows much greater secondary changes. As in primary roots, the protopleptome abutting on the endodermis is still visible though gradually diminishing in size due to the encroachment of the secondary leptome. The proto- and metahadrome vessels are surrounded by secondary hadrome vessels of increasing caliber toward the cortex. The secondary tracheae are mostly of the spiral and more rarely of the scalariform type. The endodermis which is composed of very irregular cells is very distinct. The cortical parenchyma differs in no way from the cells of the periblem of the primary root as to structure but there is a noticeable increase in size of the cells of the former. Chloroplastids are confined chiefly to the layers of the cells exterior to and bordering upon the endodermis and intercellular spaces are scattered throughout the cortex. The cells of the epidermis show a marked cutinization on the lateral as well as outer and inner faces.

COTYLEDONS. (Fig. 9).

The petioles of the cotyledons are somewhat flattened along their ventral and dorsal faces. The epidermis is composed of thick-walled cells in which they are anticlinally larger than periclinally. The ground substance is composed of thin-walled, many-sided,

parenchymatous cells rich in chlorophyll and with no intercellular spaces. The chlorophyll is confined mainly to the periphery. The centrally placed fibrovascular bundle is of the collateral type with the hadrome facing the upper or ventral face and the leptome pointing toward the lower or dorsal face.

On either side of the main fibrovascular bundle close to the lateral margins of the petiole and along the same plane are situated, among the parenchyma cells two strands of incomplete wood-bundles (Fig. 9 Vs.).

The cotyledons themselves (Fig. 10-11) in structure are of the bifacial type. In cross section the internal ground-tissue (mesophyll) is composed of thin-walled parenchyma cells of different outline. Just under the upper epidermis (Ep.) there are two rows of more or less elongated cylindrical cells which form a rather compact palisade-tissue; while the cells of the spongy parenchyma, filling the lower half of the ground-tissue, are less regular as to shape and arrangement. Due to this irregularity the intercellular spaces are much larger in the spongy tissue than they are in the palisade tissue, but there is, nevertheless, free passage from the lower to the upper epidermis. All the cells of the ground-tissue are rich in chlorophyll. In the fibrovascular bundles the hadrome (Had.) is placed superiorly next to the palisade tissue with respect to the underlying contiguous leptome (Lep.) next to the spongy parenchyma. The epidermis is composed of thin-walled cells in which different stages of formation of stomata may be observed communicating, when fully developed, with the chlorenchyma by intercellular spaces. (Ep.-Ep', the former the upper the latter the lower epidermis). A surface view of the epidermis (Fig. 11) shows cells containing many protoplasmic granules confined close to the walls. The elliptical stomata average about $630\ \mu$ distant from one another, and the structure of the upper face differs in no essential way from that of the lower. The epidermal cells in surface view range from $315\text{--}540\ \mu$ in width and from $630\text{--}1008\ \mu$ in length.

THE EPICOTYL. (Fig. 12).

The fibrovascular structure (mestome) of the epicotyl presents characters different from those of the hypocotyl. The mestome is arranged into four, more or less, separate strands of no definite shape with secondary meristem occupying the position between

hadrome and leptome forming open collateral vascular bundles. The intrastelar fundamental tissue is composed of thin-walled parenchymatous cells varying in size with no marked elongation in any direction. The tracheae are spiral, annular, and scalariform in type, the last mentioned are only occasionally met with.

The endodermis limiting the stele is much more conspicuous than in the hypocotyl both as to uniformity of shape and to the lateral suberization of the cellwalls which, in cross section, appear as dark spots. The remaining cells of the extrastelar fundamental tissue are thin-walled, polygonal in outline and well filled with starch. There are no intercellular cavities found either in the cortex or medulla. Cutinization is so pronounced in the cells of the epidermis that the cell cavities are remarkably reduced.

ANATOMY OF THE MATURE PLANT.

THE ROOT. (*Fig. 13-14*).

The dermatogen (*Fig. 13*) is composed of cells which have cuticularised to some extent along the lateral and inner walls and to such an extent along the outer walls that the cuticular membrane so formed becomes stripped off at irregular intervals forming surface projections. The length of the cells is approximately twice their width. The cells of the hypodermis differ in no marked degree from those of the dermatogen in size; their cell walls, however, are not very much thickened. The entire extrastelar ground-tissue is composed of rather large polygonal thin-walled parenchymatous cells very much elongated along their vertical axes containing many protoplasmic granules, and an abundance of starch grains which are found as far outward as the epidermis inclusive (*Fig. 13 St.*). Calcium oxalate crystal aggregates are very common. Two layers of cells next to the hypodermis as seen in longitudinal section (*Fig. 14*) are from 3 to 5 times as long as broad, the others though of the same width as the former are from 6.5 to 10 times as long. The endodermis though not very distinctive is readily recognized from the rest of the extrastelar fundamental tissue without and from the adjoining tissue within.

The pericycle, well marked in young roots, loses its characteristic appearance partially or entirely, so that it is only occasionally able to be differentiated in older roots. The secondary changes in roots that are quite mature are most evident in the hadrome of the fibrovascular bundle where it occupies the entire central portion

of the stele. The larger vessels of the hadrome are mostly reticulately pitted (Fig. 14, 8 and 2) and scalariform pitted (Fig. 14, 1). The articulations of the reticulate vessels where the absorbed transverse walls existed are not uncommonly met with (Fig. 14, 8, 2). The vessels of small caliber are usually of the spiral, reticulate and occasionally of the annular type. Sclerenchymatous tissue (wood-fibres) (tracheids) were always found to be present in old roots. The fibres (tracheids) are about 20 times as long as they are broad, tapering at each end and establishing communications with one another by pits. The leptome is not well developed in which the tubes with rugged walls are from 5—10.5 times longer than they are broad.

The longitudinal section of the old root (Fig. 14) shows these in order from without inward, dermatogen Ep., hypodermis Hy., periblem Cp., endodermis En., pericycle Pe., leptome L., and lastly hadrome H., composed of scalariform pitted (1), reticulately pitted (8-2), spiral (4), and annular (6) vessels, with two strands of wood fibres. (3).

THE RHIZOME. (Fig. 15-16).

The cell structure of the epidermis possesses the same external wall thickenings that the dermatogen of the root. Immediately under the epidermis are the cells of the hypodermis which are nearly twice as long as broad and as shown in longitudinal section (Fig. 16) together with the epidermis are being replaced by cork tissue (Co) formed from the newly developed phellogen (Ph). The periderm is composed of thinner-walled parenchyma cells (Phelloderm) toward the inside (not shown in section) and brick-shaped cells with suberized walls in very close union toward the outside separated by the cork-cambium. The outer cortical parenchyma is not as compactly arranged as that nearer the stele. The cells vary in shape not uncommonly isodiametric, and have much starch. The starch grains are found even in the epidermis. The endodermis stands out clearly both in cross and longitudinal sections, differing in no way from that of the root.

The fibrovascular bundles are of the collateral type with hadrome inferior to the leptome the former appearing as a solid hollow cylinder (Siphonostele). The sieve-tubes reach but half the elongation that they do in roots, and are less symmetrical as to their lateral wall arrangement. In cross section

the hadrome vessels have a brick-like arrangement, the entire strand of continuous circumference enclosed the central pith. The tracheae though differing in lumen are mostly all of the reticulately pitted type, at times, however, spiral and annular vessels are found. In the rootstock the reticulately pitted vessels are much shorter in length than in roots, with cross wall markings as plainly evident as in the latter. The medulla is composed of rather thin-walled cells very rich in starchy deposits. Calcium oxalate crystals are quite abundant in both the intra- and extrastelar fundamental tissues.

THE STEM. (*Fig. 17-18*).

The mestome bundles are open collateral with hadrome endarch tetrarch. The cambium is confined to the bundles between the leptome on the outside and the hadrome on the inside (intrafascicular cambium) being interrupted by the seeming equality of the intrastelar fundamental tissue, in which case the interfascicular cambium (between the bundles) is hardly at all developed constituting, more or less, an interrupted cambium ring. The bundles are more or less circular in cross section. The ducts of the protohadrome are of small diameter mostly annular, and pass gradually to those of the metahadrome and secondary hadrome with large caliber and spiral in type. The scalariform pitted ducts are only occasionally found. The cells of the hadrome parenchyma are thin-walled and elongated along the vertical axis of the stem (*Fig. 18 W*). The leptome tubes are approximately 10 times longer than broad, of thin walls, and are associated with the companion cells with similar walls attaining but half the length of the cells. The cells of the medulla increase both in width and length as they reach the centre of the cylinder remaining thin-walled throughout their existence. Crystals of calcium oxalate are found within the pith.

The endodermis composed of cells of about the same length as breadth with starch grains limits the stele dipping somewhat toward the medulla between the fibrovascular strands. The cells of the cortical region are all parenchymatous and no sclerenchyma was found. Chlorophyll is confined mostly to the outer cells of the cortex, and small intercellular spaces are present throughout this region. The epidermal and the underlying hypodermal cells, including possibly the cells of the third layer, are much alike as to size, shape and arrangement.

The hairs of the stem are epidermal in origin, confined mainly to the ridges of the stem (Fig. 19 E.), are formed as outgrowths from single superficial cells. In all the hairs examined protoplasm was found to be present containing besides a nucleus with its centrally placed spherical nucleolus, granular deposits (Fig. 19 A.). The hairs, cylindrical in outline with a broad base gradually tapering toward the apex, have their surfaces marked with thickenings obliquely to the vertical axes. (Fig. 19 C.).

LEAF.

PETIOLE. (Fig. 20-21).

The petioles in cross section are more or less semicircular in outline. The hadrome vessels are spiral and annular with increasing caliber toward the cortical tissue. The narrow companion cells are scattered among the sieve-tubes with heavy cross walls (Fig. 21). The pith is composed of medium-sized cells with many intercellular spaces. The endodermis in cross sections forms nearly a perfect circumference about the stele, while in longitudinal section the cells differ very much in height and thickness (Fig. 20-21 End.). Chlorophyll is scattered throughout the extra-stelar fundamental tissue as far inward as the endodermis inclusive, with starch grains and calcium oxalate crystals confined mainly to the inner part of cortex. The cortical parenchyma cells increase in size toward the endodermis. The two lateral vascular bundles one on either side of the central bundle possess vessels of the same type as those of the latter, and nothing equivalent to an endodermis sheath.

BLADE. (Fig. 22).

The transverse section of the blade, (Fig. 22) was made at about the centre of a fully developed leaf. The chlorenchyma is composed of a single layer of palisade cells compactly arranged abutting the upper epidermis, and loosely arranged parenchyma cells next to the lower epidermis, separated from one another by large intercellular spaces. The striking character of the mesophyll is the abundance of chlorophyll. The layers of cells immediately under the upper and lower epidermis, 4 or 5 rows in the former and 1 or 2 in the latter region, at opposite sides of the central bundle, are thick-walled (collenchyma) and usually devoid of chlorophyll. The spongy parenchyma viewed from the lower face has many intercellular spaces (Fig. 23). The central wood-

bundle is collateral at the base of the leaf with hadrome next to the palisade tissue, and becomes more or less concentric toward the apex. Cutinization is quite marked in the cells of the lower and upper epidermis. Comparing the face view of the lower and upper epidermis we find that the cell walls of the former are undulate while those of the latter are straight. The stomata, more or less elliptical, are nearly alike as to outline on both faces, those on the lower outnumbering those on the upper face. (Fig. 24-25, upper and lower epidermis respectively).

THE FLORAL LEAVES. (Fig. 26, a, b, c).

The hairs are simple formed from single cells in which the external wall protrudes giving the fully developed hairs a characteristic club shape (clavate) (Fig. 26 c). All the hairs are not of equal length, nevertheless all are notably clavate. They were well filled with protoplasm in which many granules were present (Fig. 26 a). The cell wall of the hairs has markings similar to those found on the hairs of the stem (Fig. 26 b). The epidermis even in so delicate a member as a petal has rather thickened cell walls.

The sub-epidermal tissue is made up of thin-walled parenchymatous cells (Fig. 26 a Sub.). The section of the petal was made at right angles to its length in all cases in Fig. 26.

RESUMÉ.

The following facts are characteristic of the plant:—

1. The rootstock is developed from the hypocotyl and part of the epicotyl, some of the former, however, soon disappears.
2. The development of plantlets from old roots by "vegetative propagation" from the region surrounding and including the pericycle. Vegetative propagation was found to be common in the members of the *Crocion* group.
3. In primary roots the plerome, at all times, was diarch.
4. In mature plants the secondary changes are most evident in the hadrome part of the mestome. It is noticeably large and compact in the rootstock and divided with the leptome in the stem into more less distinct strands.

EXPLANATION OF FIGURES.

Fig. 1. Seedling of *Crocion achlydophyllum* (Greene) Nwd. and Kacz., showing secondary branches (Srb.) of the primary root (Pr.), hypocotyl (Hl), petioles (Pet.) and their cotyledons (Cot.).

Fig. 2. Seedling further advanced than in the preceeding figure. The primary root is degenerating (Pr.) showing also secondary roots (Sr.), cotyledon scars (Cs.), leaf scars (Ls.) and stipular scales (Ss.).

Fig. 3. Lateral (A) and front (B) view of seedling in the second season's growth. (Pr.) remnant of the primary root, (Sr.) secondary roots, (R. H.) rootstock (rhizome), (C. S.) cotyledon scars, (F.L.) leaf scar (I.N.) first internode, (I.N') second internode, (S.S) stipular scales, and (L) young leaf.

Fig. 4. A much advanced seedling showing (L.S.) leaf scars which mark plainly the nodes and internodes of the rootstock. (S.R.) Secondary roots, (C.S.), cotyledon scars and (P.R.) primary root.

Fig. 5. Old roots in the state of degeneration giving rise to plants by "vegetative propagation."

Fig. 6. Cross section of primary root. (Ep.) epidermis, (Hy.) hypodermis, (Cp.) cortical parenchyma, (End.) endodermis, (Pe.) pericycle, (Phad.) protohadrome (protoxylem), (Mhad.) metahadrome (metaxylem), (Lep.) leptome (phloem).

Fig. 7. Cross section of a primary root somewhat advanced in growth showing a fibrovascular supply to a lateral branch (L.B.). (Ep.) epidermis, (End.) endodermis, (Cp.) cells of the cortical region, (P.L.) protoleptome, (Cam.) cambium, (S. H.) secondary hadrome (secondary xylem), (S.L.) secondary leptome (secondary phloem). The protohadrome and metahadrome vessels are represented with heavy dark walls in the centre of the stele.

Fig. 8. Cross section of the hypocotyl. (Ep.) epidermis, (End.) endodermis, (Cp.) cortical parenchyma, (P. Lep.) protoleptome, (Cam.) cambium, (S. Lep.) secondary leptome, (S.Had.) secondary hadrome, (P.Had.) protohadrome and metahadrome vessels, (I.S.) intercellular spaces.

Fig. 9. Cross section of a petiole of a cotyledon. (Vs.) Cells in the state of division to form a vascular strand, one on either side of the centrally placed fibrovascular bundle. (Lep.) leptome, (Had.) hadrome, (Co.) cortical parenchyma, (Ep.) epidermis.

Fig. 10. Cross section of a cotyledon. (Ep.) Upper epidermis, (Pp.) palisade parenchyma, (Sp.) spongy parenchyma, (Ep') lower epidermis, (St.) stoma, (Had.) hadrome, (Lep.) leptome.

Fig. 11. Surface view of the epidermis with stomata. Upper and lower faces are alike in all respects.

Fig. 12. Cross section of the epicotyl. (Ep.) epidermis, (Cp.) cortical cells with many starch grains (St.), (End.) endodermis, (Med.) medulla, (Had.) hadrome, (Lep.) leptome, (Cam.) cambium.

Fig. 13. Cross section of an old root. (Ep.) dermatogen, (Hy.) hypodermis, (St.) starch within the cells of the cortex (Cp.), (End.) endodermis, (Lep.) leptome, (Had.) hadrome.

Fig. 14. Longitudinal section of a mature root. (Ep.) dermatogen, (Hy.) hypodermis, (Cp.) cortical parenchyma, (En.) endodermis, (Pe.) pericycle, (L.) leptome, (H.) hadrome composed of scalariform pitted (1),

reticulately pitted (8 and 2), spiral (4) and annular (6) tracheae with two strands of wood-fibres (3).

Fig. 15. Cross section of an old rootstock. (Ep.) Epidermis, (Hy.) hypodermis, (Cp.) cortex cells with starch grains (St.), (End.) endodermis, (L.) leptome, (H.) hadrome, (Med.) pith cells heavily charged with starch.

Fig. 16. Longitudinal section of a rhizome. (Ep.) Epidermis, (Hy.) hypodermis, (Cp.) cortical parenchyma, (E.) endodermis, (L.) leptome, (H.) hadrome in which are shown spiral (c), annular (a), and reticulately pitted vessels of large (f) and small(n) lumen, (St.) starch, (Ph.) phellogen and (Co.) cork.

Fig. 17. Cross section of the stem. (Ep.) Epidermis, (Hy.) hypodermis, (Cp.) cortex cells, (End.) endodermis, (Lep.) leptome, (Had.) hadrome, (Med.) medulla.

Fig. 18. Longitudinal section of a stem. (Ep.) Epidermis, (Hy.) hypodermis, (Co.) cortex, (End.) endodermis, (L.) leptome, (H.) hadrome with wood parenchyma (w), (Med.) cells of the medulla in which calcium oxalate crystal aggregates are found (C.R.).

Fig. 19. Hairs on stem. (A.) internal protoplasm with its nucleus (N), nucleolus (O), and protoplasm granules (Pg.), (Cw.) cell wall. Surface view (C.) showing markings (Sm.). The hairs are confined mainly to the ridges of the stem (E.).

Fig. 20. Transverse section of a petiole of a mature leaf. (Ep.) Epidermis, (Hy.) hypodermis, (Co.) cells of the cortex containing calcium oxalate crystals, (End.) endodermis, (Lep.) leptome, (Had.) hadrome, (Med.) medulla.

Fig. 21. Vertical section of the petiole. (Ep.) Cells of the epidermis with thickened outer walls, (Hy.) hypodermis, (Cp.) cortex parenchyma in which chlorophyll (c), starch grains (H.) and crystals of calcium oxalate were found. (End.) Endodermis with chlorophyll, (Lep.) leptome showing sieve-tubes (St.) and leptome parenchyma (Cc.), (Had.) hadrome with spiral and annular vessels.

Fig. 22. Cross section of the middle part of a leaf showing the fibrovascular bundle of the midrib. (Ep.) Upper epidermis with the underlying layer of 3 or 4 collenchyma cells, (Ch.) chlorenchyma composed of palisade tissue (Pp.) and spongy parenchyma (Sp.), (Ep') lower epidermis and sub-epidermal thick-angled cells (Col.), (Lep.) leptome and (Had.) hadrome.

Fig. 23. View of the pneumatic tissue of an old leaf from the under face showing its large intercellular spaces.

Fig. 24. Face view of the upper epidermis of a leaf showing the epidermal cells with straight walls and stomata.

Fig. 25. Face view of the lower epidermis of a leaf and stomata. The cell walls of the epidermis are undulate.

Fig. 26. A cross section of the lateral petal cut at right angle to its length. (a) The internal structure and origin of a hair from one of the epidermal cells (Ep.), (Sub.) sub-epidermal tissue, (b) surface view of the hair showing cell wall markings, (c) low power drawing showing the characteristic clavate shape of the hairs.

V.—CRITICAL NOTES ON NEW AND OLD GENERA OF PLANTS.

BY J. A. NIEUWLAND.

RHAMNUS.

Some of the plants commonly included among the buckthorns had been even before Linnaeus put into a well recognized genus *Frangula*. Their generic standing had been adopted by writers as early as Cusa, Dodonaeus, Matthioli, Haller, C. Bauhin (Prod. 160, 1620), Tournefort, and by moderns as late as Asa Gray.¹ The characterizations by the latter author distinctive from the genus *Rhamnus* are sufficient to need no repetition here.

FRANGULA (Dodonaeus, Pempt., 6:2:25) Trew, Herb. Blackw. also Miller Gard. Dict., 8th Ed. (1768), Duhamel, Traite Arb. Arbustes I, 246 (1875), etc.

Frangula Alnus P. Miller, l. c.²

Rhamnus Frangula Linn., Sp. Pl., 193 (1753).

Frangula caroliniana Asa Gray, l. c.

Rhamnus caroliniana Walt., Fl. Car., 101 (1788).

The genus *Alaternus* might deserve consideration as a genus that may be separated from our aggregate *Rhamnus*. None of the plants are to be found in our region. *Cardiolepis* (*Endotropis*) Raf., Neog. 2, (1825) based on the *Rhamnus lanceolata* Pursh, Fl. Am. Sept., 166 (1814) has but two nutlets in fruit and the parts of the flower in 4's.

APETLORHAMNUS, A NEW GENUS

The presence or absence of petals when a constant character would seem in itself to be a almost sufficient reason to segregate a plant or plant group in to a new genus. Many such lately proposed have not nearly as notable a reason for existence and are accepted by botanists without question. We have been anything but logical in our admission or non-admission of genera. In any ordinary key for the determination of plants the student is loath to find that he must look both among the Apetalae and the Choripetalae and even perhaps the Sympetalae to be able to find

¹ Gen. Pl. 177, vol. II (1849).

² This is the stupid duplicate binary *Frangula Frangula* according to the American codes.

plants of one genus! Such is in fact the case with the generally recognized genus *Fraxinus* of the manuals. About the only notable character that determines such a genus is the uniformity of the fruit. Apply such a principle or set of principles to the orchids and what chaos would result! The characters being considered as constant we can scarcely see that petaliferous and apetalous plants should be left in the same genus.

APETLORHAMNUS Nov. Gen.

Small shrub with branches thornless. Flowers pentamerous, solitary, or 2 to 3 in the axils coming out with the leaves. Petals none: fruit a subglobose drupe with three nutlets, each three grooved.

Arbuscula sine spinis in ramis, floribus cum partibus quinis; singulis vel paucis axillaribus foliis coetaneis: petalis nullis: fructu drupaceo cum nuculis tribus, canaliculatis.

The genus is quite distinctive by its apetalous flowers. Such an important character alone were enough to require its segregation, a character that can not be overlooked.

***Apetlorhamnus alnifolia* (L'Her.) Nwd.**

Rhamnus alnifolia L'Her., Sert. Angl., 5 (1788).

LITANUM

Talinum parviflorum Nutt. differs considerably from the other members of the genus particularly by having only five stamens whereas the others have always at least twice as many. The presence or absence of a whole whorl of the floral organs is a very notable variation in flower structure and about as important as the presence or absence of petals or sepals. The capsule is quite different in shape and accordingly a difference in the placentation from the other plants of the group. This plant differs then as much if not more from its present congeners than does the newly made *Crunocallis* from the other Clayonias.

LITANUM Nov. Gen.

Planta perennis cum foliis teretibus linearibus basi dilatatis: pedunculis tenuibus, floribus cymosis parvis, sepalis brevioribus ovatis, acutis: staminibus 5, vel paucioribus, stylo staminibus longiore: capsula elliptica.

***Litanum parviflorum* (Nutt.) Nwd.**

Talinum parviflorum Nutt., T. and G., Fl. N.Am. I, 197 (1838).

MUSCARI.

In the Illustrated Flora¹ Dr. Britton has permitted the name *Muscaria* Haw. for the genus of plants typified by *Saxifraga muscoides* Wulf. in spite of the fact that there is an older *Muscari* Miller² accepted in the same work. Surely if *Elodes* Adanson (1763)³ in the same work renders the *Elodes* Michx. untenable then the *Muscaria* Haw. seems a perfect analogy. Both differ by exactly the same variations and a more exact case can scarcely be imagined. Unless one prefers to be dogmatic and arbitrary in matters of nomenclature, one can scarcely be looked upon as logical in accepting a name in one case and discarding another in a perfectly similar instance, and for reasons no bit the better or worse. It is probably better to look on the instance of the retention of *Muscaria* Haw. as an oversight that could not have come intentionally from a botanist as keen in matters of nomenclature as is the author of the Illustrated Flora.

That the names are identical is evident from the fact that the monocotyledonous plant name was corrected by Salisbury to *Moscharia*⁴ which sounds quite the same in spite of its varied spelling; for it is the pronounced name that constituted the homonym. Though as far as we can find there has been no other name suggested for the *Saxifraga* segregate as a genus caption we suggest that of *Dactyloides* under which it first appeared as a section or subgenus.

DACTYLOIDES (Tausch) Nwd., Nom. Nov.

Muscaria Haw., Saxifr. Enum., 36 (1821), not *Muscari* P. Miller (1768) l. c. *Triplinervium* Sectio Gaudin, Fl. Helv., III, 116 (1828), *Dactyloides* Section Tausch, ex DC. Prod., IV, 23 (1830).

Dactyloides muscoides (Wulf).

Saxifraga muscoides Jacq., Coll. II, 123. *Muscaria muscoides* Haw. l. c.

Dactyloides caespitosa. (Linn.)

Saxifraga caespitosa (Linn.) Sp. Pl., 404 (1753), *Muscaria caespitosa* Haw. l. c. 37.

¹ Britton, N. L., III. Flora, II, 222 (1913).

² l. c. I, 510 (P. Miller, Gard. Dict., 8th Ed. (1768).

³ l. c. I, 104, II, 537.

⁴ Salisbury, R., Gen. Pl. Frag., 25, (1866).

HOUSTONIA SEGREGATES.

The group of plants aggregated with *Houstonia* and having flowers in typical cymes, and funnel shaped corollas have beside, a habit so different from the rest that they well deserve separate generic rank. Rafinesque as early as 1820¹ had suggested the division of the group into several subgenera, and it is one of his names which had actually been taken up by Steudel² and is here selected for the group. There is as great a difference between these plants and the typical *Houstonias* as between *Diodia teres*³ and typical *Diodias* the former lately segregated as a genus. These latter can in fact be scarcely said to differ as much in habit.

Chamisme (Raf.) Nwd. Nov. Gen.

Plantae perennes aliquando suffruticosis ab *Houstonia* habitu distinctae, floribus dimorphicis purpureis vel lilacinis vel albis, corollis infundibuliformibus, cymis aggregatis. Alia ut in *Houstonia*.

Perennial plants sometimes suffruticose at the base with purplish flowers or pale. Corolla funnel shaped: flowers in leafless cymes terminal.

The perennial often suffruticose habit of these plants is a very notable distinctive character, showing very little resemblance to the tender vernal plants like *Houstonia coerulea* Linn. which is the type of *Houstonia* proper.

Type of the genus *Houstonia purpurea* Linn., Sp. Pl., 105 (1753)

Chamisme purpurea (Linn.) Nwd.

Houstonia purpurea Linn. l. c.

Chamisme ciliolata (Torr.) Nwd.

Houstonia ciliolata Torr., Fl. N. K. S. I., 183 (1824).

Chamisme longifolia (Gaertner) Nwd.

Houstonia longifolia Gaert., Fruct. I, 226, pl. 49, f. 8, (1788).

Chamisme tenuifolia (Nutt.) Nwd.

Houstonia tenuifolia Nutt., Gen., I, 95 (1818).

Chamisme angustifolia (Michx.) Nwd.

Houstonia angustifolia Michx. Fl. Bor. Am. I, 85 (1893),
Oldenlandia angustifolia (Michx.) A. Gray, Pl. Wright. II, 60 (1853).

¹ Rafinesque, C. S., An. Gen. Sc. Phys., XV, 226, 227 (1820).

² Steudel, E. T., Nom. Bot., ed. III, 776 (1840).

³ Small, J. K., Flora of Miami, 174, 175 (1913).

PANETOS Raf.

Houstonia rotundifolia Michx.¹ has been segregated from *Houstonia* by Rafinesque under the name *Panetos*. Considering in addition to the characters given by that author also that of producing numerous cleistogamous flowers a rather unusual thing in this group the genus merits consideration for segregation.

Panetos rotundifolius (Michx.) Nwd.

Houstonia rotundifolia Michx., Fl. Bor. Am., I, 85 (1803).

There are other Mexican and southern members of the genus *Houstonia* that ought to be separated from this aggregate, having flower and habit characters even more notable than those here referred to.

ARONIA MED. A HOMONYM.

On a number of occasions attention was called to the fact that several of Mitchell's names antedated others now commonly held. The publication of *Aronia*² by that author is earlier than that of *Medicus*³ or *Persoon*.

The *Aronia* of Mitchell is *Orontium* of Linnaeus and though it can not be used as a valid name itself, its previous use renders any subsequent application of the name invalid, whether its first application is admissible or not, according to the rules of the codes. Even if it had a different meaning and origin in deviation it still is exactly identical in sound and spelling.⁴ It is therefore impossible to quibble about the matter for this reason. I have been unable to find that any other name is available as an alternative application. Before the plant was admitted as segregated validly by some, a subgenus or section name was applied by Decandolle, and this may serve as a substitute for the *Aronia* antedated.

ADENORACHIS (DC) Nwd. Nom. Nov.

Aronia Medicus, Phil. Bot., 140 (1789), also Persoon, Syn. II, 39 (1807) not *Aronia* Mitchell, Diss., App. I, (1769) = *Orontium*

¹ Raf., An. Gen. Sc. Phys. I. c.

² Mitchell, J., Diss. Brevis de Princ. Bot. et Zool., App. aliquot de Pl. Virg. Obs., Norimb., Imp. Wulfgangii and Schwarzkopfi MDCCCLXIX. (See Pritzel No. 6975).

³ Persoon, C. H., Syn. II, 39, (1807), Medicus, F. K., Phil. Bot. I, 140 (1789).

⁴ N. L. Britton, III, Flora, II, 290 (1913), Kuntze, O., Rev. Gen. Pl., II, 720 (1891).

Linn. (1753) Sp. Pl. 324. *Adenorachis* DC. Prod. II, 637 (1825), as section or subgenus.

Adenorachis arbutifolia (Linn.) Nwd.

Aronia arbutifolia (Linn.) Ell., Bot. S. Car. and Ga., I, 556 (1821), *Mespilus arbutifolia* Linn., Sp. Pl. 478 (1753), *Pyrus arbutifolia* Linn. f. Suppl. 256 (1781).

Adenorachis atropurpurea (Robinson) Nwd.

Aronia arbutifolia Britton, Man., 517 (1901), *Pyrus arbutifolia* var. *atropurpurea* Robinson, Rhodora, x, 33, (1908).

Adenorachis melanocarpa (Michx.) Nwd.

Mespilus arbutifolia var. *melanocarpa* Michx., Fl. Bor. Am., I, 292 (1803) *Pyrus melanocarpa* Willd., Enum., 525 (1809).

KYLLINGA A HOMONYM.

The *Kyllinga* Rott.¹ is antedated by Adanson's *Killinga*² the latter a segregate from *Athamanta*. Though the name is slightly different in spelling it is nevertheless the same in sound and on the authority of Brevel³ named after the same Peter Kylling a Danish Botanist. The next available name not only in order but with the same type as that of *Kyllinga* Rottb. itself is *Thryocephalon* Forst. The other names as given in the Kew Index may possibly be attempts at segregation anyhow. Following is the synonymy.

THRYOCEPHALON Forst., Char. Gen., 129, t. 65 (1776).

Kyllinga Rottb. l. c. (1773), not *Killinga* Adans. l. c. (1763) nor Brevel, l. c., (1770).

Thryocephalon pumilum (Michx.) Nwd.

Kyllinga pumila Michx. Fl. Bor. Am., I, 28 (1803), *Hedychloe fragans* Raf., Ann. Nat., 16 (1820).

KOCHIA A HOMONYM.

*Kochia*⁴ Roth, is a homonym because of the previous use of *Cocchia* (Mich.) Brevel,⁵ (1770). The letters C and K are the same in Latin, and by all the systems of pronunciation the name

¹ Rottboel, C. F., Descr. Ic. 12, pl. 4, f. 3, 4, (1773).

² Adanson, M. Fam. des Pl., II, 498 (1763).

³ Brevel, J. F. B., De Pl. Cult. Mem. Nom., 40 (1770) "*Killinga* Adans. *Athamanta cret.* L."

⁴ Roth, Schrader, Journ. Bot. I, 307, pl. 2 (1799).

⁵ Brevel, J. F. B., De Pl. Cult. Mem., 28 (1770).

has the same sound. The latter name is applied as a proposed segregate with *Sideritis syriaca* Linn., as type. As we are unable to find that any other attempt has been made to name them Chenopodiaceous plant all in the Kew Index being apparently proposed segregates that might at any time be reserved for their proper groups if raised to generic standing it is necessary to give a new one, for which **Bushiola** is proposed herewith.

BUSHIOLA Nwd. Nom. Nov.

Kochia Roth l. c. (1799) not *Cocchia* Brevel; l. c. (1770).

Bushiola Scoparia (Linn.) Nwd.

Kochia Scoparia (Linn.) Roth. Neues Jour. Bot., III, 85, (1809), *Chenopodium Scoparia* Linn., Sp. Pl., 221 (1753).

PROPER PUBLICATION.

That any code putting restrictions for expediency on "starting points" arbitrarily chosen for beginning nomenclature, contains within itself its germs of destruction, will some day be conclusively admitted, as better knowledge and far-sighted logic throw more light on these problems. Nevertheless in matters of plant names we fail to see that a logical structure can not be built on a faulty foundation without ending in chaos. Most of our latest codes and the American with them agree to accept 1753 as the beginning of nomenclature for botany. No generic descriptions having been made in Linnaeus' *Species Plantarum*, the generic names are to be accepted as to their validity for "proper" publication by reference to the *Genera Plantarum* of 1754 with a special provision of code to cover this specific instance. In the Vienna Code rules we are told that "the rules of nomenclature should be neither arbitrary nor imposed by authority," (Art. 3) and then it proceeds in the most high-handed and arbitrary manner to publish over 20 pages of *nomina conservanda* that must be retained; and this because the code makers can give no good reason why they should be. This is done, too, without any attempt at exciting our humorous feelings.

Already, much dogmatic and canonical teaching has gone forth as to what constitutes "proper publication." It is not sufficient that for a validity of a name we be quite certain as to its identity. Among these "canons" required in order that

a name be "properly published" according to certain followers of the American Code¹ we have the one that a genus must have a "reference to a specific description which is associable by citation to a *previously published binomial species*." (Rule 3. Canon 10, Am. Code). In order to make this statement reasonable and logical, it will be necessary again to make an exception in the favor of Linnaeus himself, just as arbitrary as any of the above mentioned cases. Unless we do this, then at least three of the Linnaean genera of the *Species Plantarum* of 1753 were never "properly published," at least by Linnaeus in 1753, namely *Musaenda*, *Erythronium*, *Hydrocharis*.

None of these are published in his work *either with or by direct citation to a binary name*. They are there monotypic, having only the species *Musaenda fructu frondoso*, *Erythronium Dens canis* and *Hydrocharis Morsus Ranae*, and these are *not binomials*, nor were two of them at least *binomials* in the second edition of 1762-3.

Are we then to consider these names as not "properly published?" That the exponents of the code do consider them "properly published" is evident from the fact that they use these names in their floras and manuals as attributed to Linnaeus (1753),² though not perhaps without surreptitious, and may I add perhaps, dishonestly inserted hyphens, in order that the unwary might not suspect. Necker's names may be rejected for a purpose, but Linnaean ones under similar conditions are to be accepted, nor are the descriptions of either author of themselves more than poor, the advantage if any being in favor of Necker. It would seem then that the more we increase the number of "rules" and "canons" of "codes," the more we are obliged to have arbitrary exceptions thereto, thus ending it all in a flood of dogmatic lawlessness, or making confusion worse confounded. When rules are made let the "codists" at least honestly try to keep them.

¹ Bull. Torr. Cl. XXXXII, 117 (1915).

² Britton and Brown, Ill. Fl. N. Am. 1, 505, (1913).

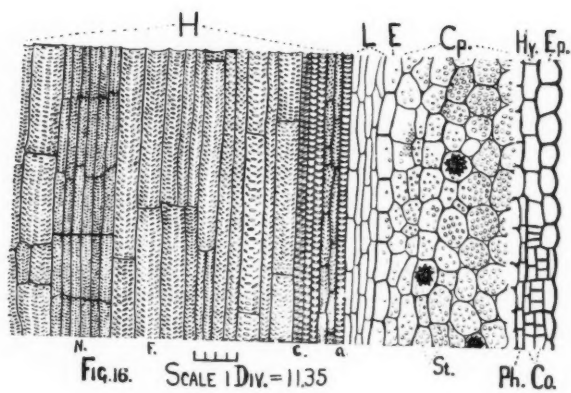
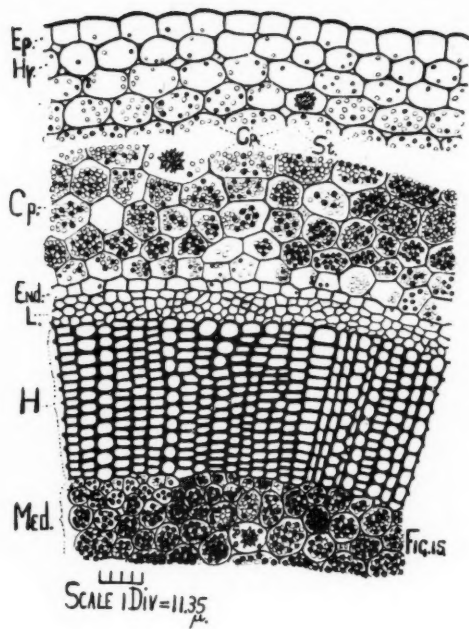
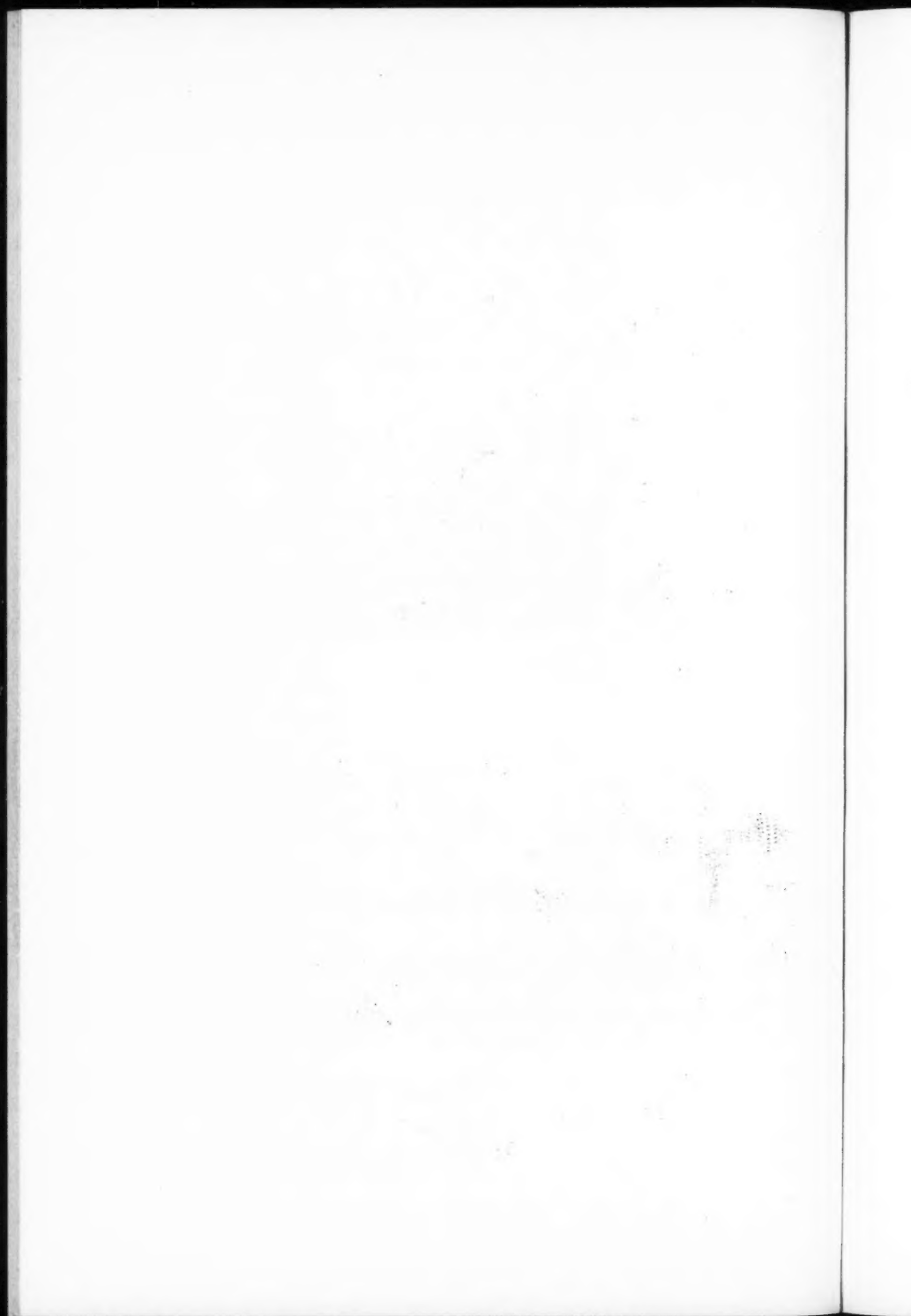


PLATE VIII. KACZMAREK ON CROCION.



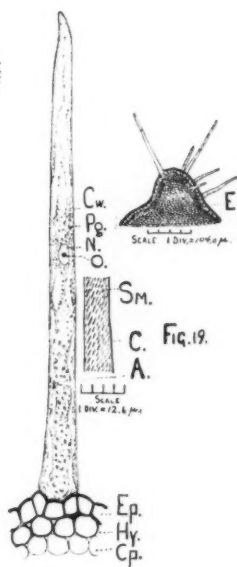
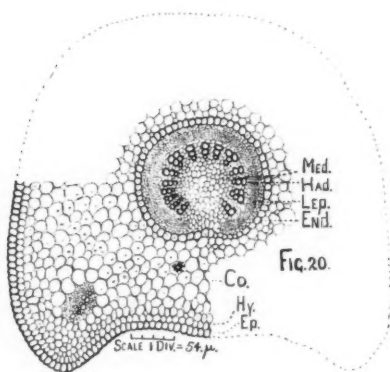
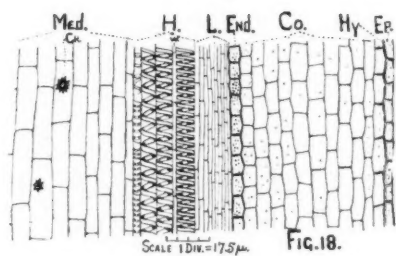
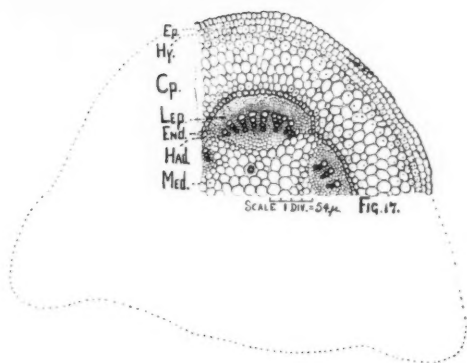


PLATE IX. KACZMAREK ON CROCION.



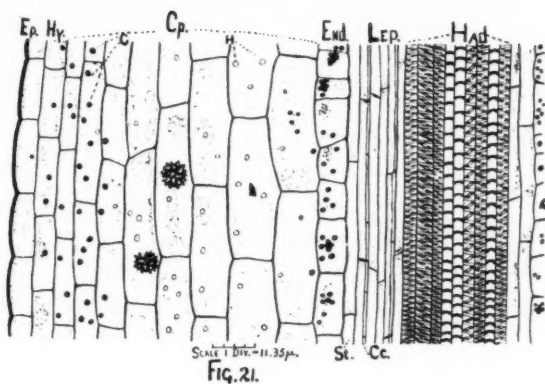


FIG. 21.

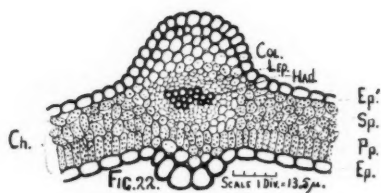


FIG. 22.

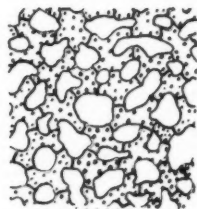


FIG. 23.

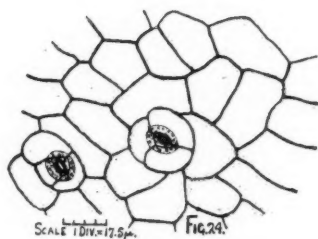


FIG. 24.

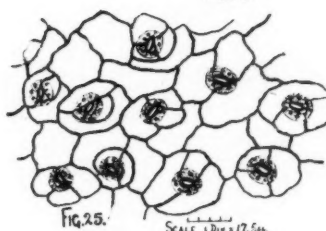


FIG. 25.

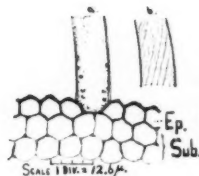


FIG. 26.





